THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
A Legal Minimum Standard of Wages	581
The Proposed Electrification of the Melbourne Suburban Railways	582
Telephone Private Wires	583
Local Authorities and Cable Laying	583
The Electrical System of the L.C.C. Tramways	583
The Lowest Tender...	584
Electrical Time Service in Mauritius (*illus.*)	585
Proceedings of Institutions:—	
Researches on the Magnetic Properties of a Series of Carbon-Tungsten Steels (*illus.*)	587
The Continental Electrical Engineering Industry	590
Parliamentary	591
Legal	591
Correspondence:—	
The Maintenance of Large Gas Engines	593
How to Catch Rats	593
Sales Engineers	593
Supply by Meter, or Contract?	594
Business Notes	594
The O.S. Wiring System (*illus.*)	601
Notes	602
City Notes	605
Stocks and Shares	608
Electric Tramway and Railway Traffic Returns	608
Share List of Electrical Companies	609
Metal Market.—Fluctuations in March	611
Proposed Electrification of the Suburban Railways of Melbourne, Victoria	611
Electrical Conveniences in the Modern Power House... ...	613
Who Said Overhead Wires?	614
Reviews	615
Foreign and Colonial Tariffs on Electrical Goods	619
New Patents Applied For, 1909	620
Published Specifications	620

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THE

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(J. A. BERLY'S).

1909 EDITION

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A LEGAL MINIMUM STANDARD OF WAGES.

THE House of Commons devoted a part of two days recently to the consideration of two Bills, the main object of which is to establish by law a minimum standard of wages in certain trades. One of these, the Trade Boards Bill, was introduced by the President of the Board of Trade, and was read a first time; whilst the other, which was a private member's Bill entitled the Sweated Industries Bill, was, after many speeches had been made for and against its second reading, adjourned on the recommendation of Mr. Churchill, so that it might be kept alive ready to step into the breach if the Government Bill came to grief.

The Trade Boards Bill proposes to establish Trade Boards in certain trades where the evil known as sweating prevails, and to entrust to these Boards the fixing and enforcement of a minimum standard of wages. The trades which are scheduled as those to which the Bill will immediately apply are the ready-made tailoring trade, cardboard box making, the machine-made lace and net finishing trade, and the ready-made blouse trade; but power is taken to extend the provisions of the Bill to other trades by an order, which will acquire validity when it has lain upon the table of the House for 30 days unchallenged. It is proposed to establish for each trade a Central Trade Board composed of representatives of employers and workpeople in that trade, who may be appointed either by nomination or by election at the discretion of the Board of Trade, and to those representatives will be added on each central Board three expert paid official members. This central Board will establish district trade committees, consisting of representatives of employers and employed, and of a proportion of the members of the central Board; and these committees will recommend a minimum rate for time and piecework in their districts, which will be considered by the central Board, and, after an interval in which to hear objections, may be approved and prescribed by it.

As soon as a minimum rate is prescribed and published by the central Board, it becomes obligatory on Government and municipal contractors; it is proposed to publish a white list of those employers who voluntarily agree to be bound under a penalty to observe this minimum rate, and no one whose name does not appear on this list will be eligible for any Government contract. Further, at any time not less than six months after a minimum rate has been prescribed, the Trade Board may, on application to the Board of Trade, make this rate obligatory by law. Powers are taken to establish a system of inspection by officers, who will have the right of entry into factories, workshops, and places where work is given out, at all reasonable times, and who will work under the Trade Board in each particular district.

The Sweated Industries Bill makes the following provisions according to the Memorandum printed with the Bill :—"The object of this Bill is to provide for the establishment of Wages Boards with power to fix the minimum rate of wages to be paid to workers in particular trades. The Bill will apply in the first instance only to the trades specified in the schedule. Power is given to the Home Secretary to say to what other trades the Bill is to be extended, and no doubt at first the extension will be made only to what are known as the 'sweated industries,' that is, industries in which outworkers are largely employed, and in which the rate of remuneration is low. A Wages Board will have power to fix a minimum rate for any single kind of work, and will have the widest discretion as to fixing time rates or piecework rates, and as to varying the minimum according to the locality, the kind of work, and the persons employed. The Bill provides that a Wages Board shall be composed of representatives of employers and representatives of employed in equal numbers, with a chairman chosen by the members, or nominated by the Home Secretary. It is proposed to entrust the enforcement of payment of the minimum rate to factory inspectors."

Both these Bills embody a most important departure from the principles of legislation hitherto observed by both the main parties in Parliament; and, however much we may sympathise with the intention of the Bills to improve the lot of the sweated worker, we cannot but consider that there is great danger that the result of their application may be to make matters worse than they are at present. It evidently is assumed by the authors of these Bills that the very low wages paid in certain trades are due entirely to the desire of an unprincipled employer to make a large profit by underpaying his workpeople; and, when that is the case, we have nothing to say against a raising of the rate of pay. There are, however, other causes which operate to keep wages low; and it is on account of the apparent inability of the Labour Party and of their supporters in the Government to grasp this fact, that we are afraid of the effects of these Bills. For example, there are some trades in which certain operations may be carried out by hand labour or by machine; and although the hand-made article may fetch a higher price than the machine-made one, yet the difference in the selling price is not large, with the result that the wages of the hand-worker are kept low by the competition of the machine-made article. If, in such a case, the rate of wages of the hand-worker is raised by the Wages Board, and it is made a penal offence for any employer to pay a lower rate of wage, it is evident that the hand-made article will no longer be able to compete with the machine-made one, and the hand-worker will lose his or her employment. The same difficulty will be met in cases where the particular industry is carried on abroad as well as in this country, so that the home-made article is in competition with a foreign-made one; and unless we are prepared to demonstrate that there is no longer any truth in the old saying that "half a loaf is better than none," we must very carefully consider the effect of increasing the rate of wages in each case, to make sure that we do not, with the best intentions, make the condition of these low-paid workers change from bad to worse.

With regard to the possible extension of these Bills to trades which cannot be classed as "sweated industries," we consider the powers given are much too wide. In the Trade Boards Bill, we are told that its provisions may be extended to other trades by an order which will be laid on the table of the House, and if unchallenged for 30 days will come into force. Nothing, however, is said as to the procedure which may lead to such an order being tabled, and we do not yet know if it will rest entirely with the Board of Trade to take the initiative, or whether provision is made that any body of persons interested in a particular trade will be allowed to apply to the Board of Trade to have it scheduled, or whether any public inquiry will be held to obtain evidence for and against the extension before an order is made. The Sweated Industries Bill empowers the Home Secretary, on application being made and an inquiry being held, to direct that a Wages Board shall be established for any trade in any district; the conditions under which an application may be made being defined in Clause 2 as follows :—"Application for the establishment of a Wages Board for any trade in any district may be made to the Secretary of State by any Trade Union or Trades Council which represents persons employed in the trade in the district, or by any six persons who are either employers of labour or employed in the trade in the district."

In the latter case there is nothing to prevent a Trade Union, or any six workmen who want a rise of wages, from applying for the establishment of a Wages Board for a trade where the wages are far higher than the so-called living wage; nor is there anything to prevent the Home Secretary of some future Government, should he wish to please the Labour Party, from directing the establishment of such a Board. There is, indeed, every inducement to the workmen to make such an application, as it is a case where the stakes are not equal; because, if the Wages Board fixes a higher standard of wages, the employer who pays or offers to pay a less rate is guilty of an offence against the Act, and is liable on summary conviction to be fined; whereas, if the decision of the Wages Board is not in favour of the workmen, these are under no obligation to accept the decision, but can go on strike, or seek work in other districts without being guilty of any offence against the Act.

The possibility of such action as is outlined above will be very disturbing to trade, and we consider that both of these Bills will require amendment so as to restrict their application to such trades as can fairly be called sweated industries. We would suggest, in the first place, that the application of either Bill should be limited to cases where the rate of pay is below certain standard rates for men, women and young persons, and that these rates should be fixed by Parliament and scheduled in the Bill; and further, that the extension of the Bill to other trades than those specified in the schedule should only be possible after the holding of a public inquiry by a Committee of the House, or by appointed commissioners, who, after hearing the evidence on both sides, would decide whether a Wages Board or Trade Board should be appointed.

The Proposed Electrification of the Melbourne Suburban Railways.

In another part of this issue will be found an abstract of a digest of Mr. Merz's report to the Victorian Railway Commissioners. Our readers know already that no part of Mr. Merz's scheme is to be carried through at present, and probably not for some years; and we venture to predict that by the time that the Commissioners feel bold enough to bring forward again the proposition to electrify the suburban railways, so much progress will have been made in other parts of the world that a new report will be required.

Mr. Merz has produced a masterpiece, but we cannot help wishing that he had been able to demonstrate the commercial success of electric working on the Melbourne railways without so much strain. His position would have been stronger if he had anticipated the report of the Commissioners, which appeals to us as suggesting the wisest course for the State to adopt. Very possibly political considerations have helped the Commissioners to form their opinion, but of these we know nothing, and we can only say that on its merits only as a financial proposition it would not have been just to the citizens to put Mr. Merz's scheme into immediate operation. The margins shown by Mr. Merz were very small, and the

Commissioners have arrived at even less favourable figures with regard to expenditure, interest, and cost. It is only right, however, to explain that the alterations in the estimates have not been submitted to Mr. Merz, which, so far as he personally is concerned, seems hardly fair. Nevertheless, we can only suppose that the Commissioners really wanted to get at the truth of the matter, or they would not have gone to the trouble and expense of sending to Europe for advice, and the least we can do is to give them credit for sincerity in their opinion that electrification is not indicated at present by their interpretation of the auguries. If their recommendations are carried out, the next five or ten years should see the lines in a much more favourable condition for electric traction than they are now.

Telephone Private Wires.

On Friday last the House of Lords delivered judgment in the appeal of the Postmaster-General against the decision of the Court of Appeal. The litigation commenced in 1907 when Mr. Justice Swinfen Eady, on a special case submitted by consent for the opinion of the Court, decided that royalties must be paid to the Post Office in respect to certain lines in dispute defined in the first schedule to that case (Electrical Review, March 29th, 1907, p. 511). Against this decision the National Telephone Co., appealed and the case was heard by the Court of Appeal and decided in favour of the company (Electrical Review, June 5th, 1908, p. 937). The Postmaster-General carried the case to the House of Lords who have reversed the decision of the Court of Appeal and restored the decision of Mr. Justice Swinfen Eady, so that the final decision of the case is in favour of the Postmaster-General.

The judgment of the Lord Chancellor, as published, does not deal specifically with the two schedules as did the Court of Appeal, from whose report it is to be gathered that the lines in the first schedule were doubtful as to the payment of royalties, and the lines in the second schedule were doubtful as to whether the Postmaster-General's licence was, or was not, contravened by them. The reversal of the decision of the Court of Appeal presumably applies to both schedules.

It may be inferred, therefore, that the practical bearing of the case affects not only the question of royalties, but also the question of the amount to be obtained for the lines under the agreement for purchase. This agreement provides in Clause 4 (sub.-Sec. 4) that three years' profits shall be paid upon private wire business, and in the recital it is agreed that "private wire business" is telephonic business, which may by law be transacted without the licence of the Postmaster-General.

As the schedules have not been published, it is not possible to form any idea of the number or value of the doubtful lines of either type.

The Lord Chancellor has justified the doubts by his comments on the slovenliness of the language of the Telegraph Acts, which required to be interpreted, but in justice to their draughtsmen, it is to be remembered that the invention of the telephone has made practicable and commercially useful a type of service which does not come within the accepted purpose of a public exchange, and is yet beyond the capacity and usefulness of an A to A line. Before the era of the telephone private lines were limited and exclusive. The Legislature apparently intended the Post Office to have a monopoly of public telegraph service, but recognising the difficulty in preventing on occasion the transmission of a message over a private line on other than the business of the owner, provided that any such transmission must be gratuitous. There was a certain amount of assurance that the revenue would not suffer seriously from the transmission of gratuitous messages, since the owners would hardly be likely to allow their lines to be loaded, and their expert servants employed to any considerable extent with other people's business. The decision of the House of Lords practically reduces the area of permissible private telephone wires to the A to A lines.

Local Authorities and Cable Laying.

The electrical world has long been accustomed to hear that the supply of electricity is a matter which should be left in the hands of the municipalities. Whilst not admitting the validity of this claim, we are prepared to admit that the local authority is in a more favourable position than a company supplying electricity. Take, for instance, the question of laying cables near the property of any gas or water company.

Foreseeing that the laying of cables might be prejudicial to these bodies, the Legislature expressly provided in Electric Lighting (Clauses) Act, 1899, Sec. 18 (1) that where the undertakers require to dig or sink any trench for laying down or constructing any new electric lines (other than service lines) or other works near to which any sewer or drain under the jurisdiction of the local authority, or any main belonging to any gas, electric supply or water company has been placed, the undertakers shall give to the local authority, or to the gas or water company, not less than three days' notice, in order that the owners may, by their officer, take proper steps to protect such gas or water pipe. It is material to notice that this provision has no application to local authorities, for, by Sub-sec. (7) of the same clause: "Where the local authority are themselves the undertakers, the references in this section to the local authority, and to sewers, drains, water courses, defences or works under the jurisdiction of that local authority, shall not apply." This omission would not call for comment if local authorities laying mains could always be relied on so to place them that persons subsequently repairing the drains should not be incommoded. A case illustrating this point has recently been tried and decided by Judge Parry at the Salford County Court.

It appears that there were certain drains in a schoolyard at Salford. Some years ago the Corporation of Salford, who supply electricity and also have the sewers, &c., under their control, laid certain cables in this schoolyard, but they laid them over the drains. In March, 1908, a firm of contractors, Messrs. Duncan, Carmichael & Co., were employed to repair the drains. In doing these repairs, injury was occasioned to the cables, for which the Corporation brought an action, alleging that there must have been negligence on the part of the contractors. Counsel for the contractors called attention to and relied on the Electric Lighting (Clauses) Act, 1899, as above quoted, and pointed out that the trouble would not have arisen had the Corporation been subject to the same liability to give notices as a private lighting company. Judge Parry took this view. In giving judgment, he said:—

This action would not have been necessary if the electric light had been supplied by a private company, having regard to the Electric Lighting Clauses Act, 1899. I should have thought that the Health or the Sanitary Committee, which has the care of the drains and sewers, would have looked after the Electricity Committee. It seems an extraordinary thing that the Corporation should have a lower morality—if one may so put it—than private companies. It is the boast of corporations that they do things better than private companies, but in this case it does not appear to be so. It is admitted that there are no regulations in existence for the laying of pipes. The Corporation should have some such rules and regulations as are provided for private companies under the Electric Lighting Clauses Act, 1899. The Corporation has been negligent in putting the cables over the drain instead of under it, and I can find no negligence on the part of the defendants. So far from the Corporation suing the contractors, they ought to consider themselves lucky they did not injure the labourer, and so lay themselves open to a serious action for negligence.

The Electrical System of the London County Council Tramways.

The title of Mr. Rider's paper, which was read at the meeting of the Institution of Electrical Engineers on March 25th, and discussed again on April 1st, is somewhat narrow, for the paper was fully as descriptive of the steam as of the electrical equipment. One or two points of special interest may be referred to more particularly. To draw large supplies of water for condensing from near the bed of a muddy tidal river has before now proved difficult.

at Greenwich the problem has been solved by the usual system of reversed flow combined with a rotary sieve so arranged that every two minutes the portions of the grid on which the incoming water deposits its load are washed clear by the outgoing water. More of the 30-in. pipes also are used as incomers than are used as outgoers, and so the tendency is minimised to draw in *débris* and the maximum outgoing scour is maintained. Ultimately, there will be four incomers and two outgoers. Make-up water is obtained from a "chalk" well; the water is hard, and is softened by means of lime and soda. The result of soda treatment must be to accumulate sodium sulphate in the water. Now, this salt is provocative of priming, and it is found necessary to blow down each working boiler 5 in. every night to keep down the alkalinity, if sulphate of soda can be called alkaline. This means a considerable loss of water and a great loss of heat, which does not seem to be regenerated in any way. And after all, the water is only softened to 7° or 8°. The procedure seems unavoidable, but presents itself as an argument for treatment by barium salts, which do not leave a residual salt in the boiler as does soda. And barium salts only await a cheap electrolytic process of manufacture, in order to enter the field of most useful water softening.

The total cost of the station is nearly £24 per KW., which seems heavy in comparison with Mr. Merz's £8. The cost per unit is given as 0·3311d. exclusive of capital charges, and coal is consumed at the rate of 3·1 lb. per unit delivered to sub-stations.

With 180 lb. boiler pressure and superheat temperatures of 460° and 446° F. respectively, the full and half-load steam consumptions of the Musgrave engines are given as 16·88 and 16·67 lb. respectively per KW.-hour, or 11·098 and 11·31 lb. per I.H.P.-hour. This may be compared with the guaranteed steam consumption of the newer turbo-generators of 15 lb. with the same boiler pressure and a superheat temperature of 550° F., or about 100° in excess of the temperature of the reciprocating test. The vacuum is to be 95 per cent. of perfection, with circulating water at 65° F. and Edwards pumps reinforced by an augmentor. Mr. Rider, therefore, hopes considerably to surpass the efficiency of his older engines without, as he himself says, risking any stripping of blades by a too-close attention to low steam consumption in a finely fitted turbine.

Turbines are to be adopted only from considerations of output, space and price. We had been under the impression that something might have been due to the same general influence which has given two very ugly chimneys in place of two equally ugly, but taller, chimneys of the intended design.

It would have been a welcome and valuable addition to the paper to have included what, if any, economy has resulted from the live-steam-heated intermediate receivers between the H.P. and L.P. cylinders. The effect of these heaters has been so widely disputed that some very valuable information might be given by a few tests. Many engineers dispute any practical gain from reheaters, though they look well from the point of theory. Do they pay? Again, do they pay when the H.P. cylinder is fed with superheated steam, or *vice versâ?* We trust Mr. Rider will see the way clear to elucidate the facts, for at least the particular case of the Greenwich engines. It is well worth some endeavour to ascertain.

Such, then, are the main points which present themselves in what forms an excellent description of a large tramway power station.

The Lowest Tender.

It is refreshing to come across instances of the lowest tender being rejected in favour of one which is higher. This course is hardly ever possible in the contracts of public bodies, although it may be desirable in many cases; and it is doubtful whether the cause of public morality would be served if the Local Government Board's vigilance in this matter were relaxed.

Nevertheless, the certainty that the *bona fides* of the contractor would be given real consideration by those qualified to judge would put an end to the cutting which now is crippling so many industries.

In the term *bona fides* we include the intention to quote a price which will produce a fair trading profit if the work is carried out in accordance with the specification, and assuming that the supervision and organisation are good enough to prevent administrative waste.

That in many instances cutting is not only carried to a stupid and short-sighted degree, but is informed by veritably criminal intentions, is too well known to be argued here. Nor does any legal remedy appear possible. Leaving aside the firm which deliberately makes a living out of its creditors, and does it as long and as often as it can, there remain the class of firm which is inexperienced, and begins by under-estimating out of real ignorance: the class which cuts to make a business, hoping that when a business is established, it will be able to raise its prices to remunerative levels: the class which tenders on the worst and cheapest grade of material for work in which the specification, if it exists at all, is drawn up by each tenderer according to his idea of how the work should be done: and the class that has an old-established business, and probably supplies good material on principle, but cuts down labour charges below anything possible to a self-respecting firm which will not abuse the apprentice or premium pupil system.

We have two apt illustrations from recent competitive tenders. In both cases a strict and sound specification by different engineers was the focus, and a limited number of firms were invited to tender, in one case five, and in the other, four only.

Case I.			Case II.		
Firm.		Price index.	Firm.		Price index.
A.	...	1	A.	...	1
B.	...	1·19	B.	...	1·46
C.	...	1·27	C.	...	1·46
D.	...	1·36	D.	...	1·49
E.	...	2·2			

In both cases the consulting engineer recommended that the lowest tender should not be accepted, on the ground that the work could not be done at a profit at the lowest figures. There were strong suspicions, founded on previous experience, that Firm A in Case I was cutting merely for the sake of building up the electrical branch of the business, and that Firm A in Case II intended to use apprentice labour very largely. Whatever the motives, it was certain that both firms must make a loss if the best work and the best material were used, as called for in the specifications, and the consulting engineers were safeguarding their clients' interests and saving themselves a great deal of needless trouble by acting as they did. At the same time they were promoting the welfare of the best class of contractors.

How far is it possible for consulting engineers to work on these lines? Often it would happen that a suspicious or blindly mean client would reject his consulting engineer's recommendation to accept some tender other than the lowest, thinking either that the engineer was looking to his percentage commission, or that the wiles of a cutting contractor would be circumvented by the vigilance of the engineer. Probably the system would be abused by the less scrupulous among those gentlemen who go by the name of consulting engineers, and, in any event, as things are now, no public bodies and very few public institutions would be able to accept anything but the lowest tender for fear of surcharges and other penalties.

One wishes that it were possible to stipulate in a specification that no tender below a minimum figure would be considered. That would necessitate the consultant knowing his business so well that he can estimate the real cost of any work done in the way he wishes. The minimum price might be the price at which the engineer thinks the work can be done without profit, or he might feel that his client's interest will be served better if even the contractor who is willing for his name's sake to do the work at cost shall be forced by the "minimum" clause to work at a profit. No decent-minded man wants to see a contractor losing money, or slaving for little or no profit, and no decent-minded contractor will scamp his work with the idea of making money by hook or by crook if the basis of the contract is such as to ensure him a profit.

For a hundred reasons this plan would break down if it were adopted commonly, and the clients would suffer always, but it might do well in special cases, and is, perhaps, not unworthy of consideration.

ELECTRICAL TIME SERVICE IN MAURITIUS.

By E. D. PEARMAIN.

The Island of Mauritius, which was once, as its motto proudly states, *Stella clavisque maris indici* (Star and key of the Indian Ocean), has lost much of its former importance since the advent of steamships and the opening of the Suez Canal. Its principal harbour, Port Louis, however, is still of considerable value to the Mercantile Marine, as it forms the terminal port of several of the big lines of steamers, such as the Union-Castle line, British India S.N. Co., Messageries Maritimes, &c., and is a port of call for the Ellerman, Harrison, Clan, Persian Gulf, and other lines,

Time Ball and Mast.

which undertake the transport of its sugar and fibre, the staple industries of the island. It is also visited annually by the Cape Squadron of H.M. Navy.

Under these circumstances an accurate system of time signals is of the utmost importance to these vessels for the proper checking and timing of chronometers, and as its Royal Alfred Observatory furnishes meteorological information of great value, especially during the cyclonic season, it was felt to be imperative that the standard clocks at the observatory should be absolutely free of errors due to climatic conditions. Accordingly, in 1905, a scheme was drawn up by the author for the installation of an electrically-operated time ball and recording dials, &c., and the necessary funds having been voted by Government, the work was commenced towards the close of the same year.

It would be advisable here to briefly describe the system of signals previously in use, in order to better understand the reasons which led to the improvements. The old time ball was erected on the Signal Mountain, which faces the harbour, and had an elevation of 1,060 ft., but, unfortunately, during certain seasons of the year, the ball was hidden by mist, sometimes for consecutive days, which rendered sights from ships in harbour very uncertain and almost impossible. The standard mean time clock was fixed in the transit room at the top of the observatory building at Pamplemousses, 7 miles away. The signal to drop the ball was sent by an observer who watched the clock and signalled by a Morse key. The signal was conveyed by an overhead line to the time ball, received on a relay and bell, and the ball was dropped by hand.

It is not surprising that there were many irregularities under these several disadvantageous conditions. The standard clock being fitted, as already described, at the top of the observatory building and the sidereal clock on the ground floor in the computing room, also led to errors caused by temperature variations, shocks and draughts, &c.

The regulation of these clocks was effected by hand, which was rather inefficient. The first part of the work to be taken in hand was the construction and erection of the time ball and mast on the Port Tower, which faces the harbour.

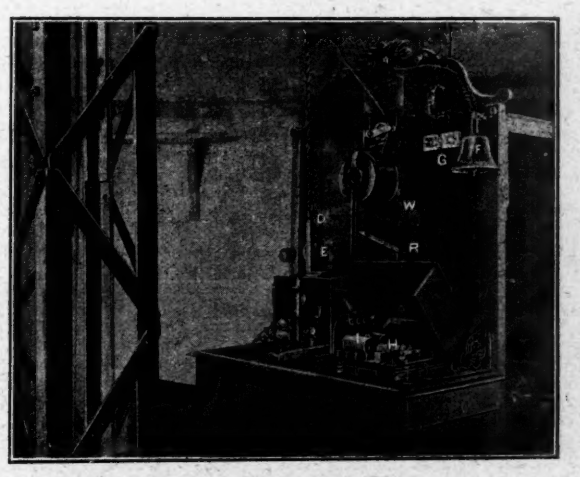
As shown by the first view, the mast is a square one, of iron lattice work, and is carried right down through the tower into a concrete foundation set in the coral. The ball is constructed of two square angle iron frames, fitted with rollers at all the corners, top and bottom, and stayed by tubular distance pieces. From these square frames 12 semi-circular steel ribs spring and are securely stayed together, and over this the canvas is stretched.

The ball is a flattened ellipse, 4 ft. 6 in. diameter × 5 ft. 6 in. long, and has a clear drop of 20 ft., which it accomplishes in 1½ seconds; the first 10 ft. occupies only ·3 of a second, and for the remainder of the fall the ball gradually loses velocity, by means of the apparatus to be presently described.

The shock of the fall is taken finally on 16 spring buffers. The centre of the ball when raised, as shown, is 65 ft. above sea level, and the weight of the complete ball is 75 lb. A chain counterpoise is fitted, weighing 70 lb., and is connected to the ball by means of a wire rope running over a pulley on the cross-arm C.

When the ball is raised the chain coils itself in a box at the foot of the mast, and as the ball drops weight is added to the counterpoise, link by link, as the chain is lifted, until the ball comes gradually to rest at B. This allows the ball to start away with a high velocity from the arm, and it is at this moment that the observation is taken.

The controlling arrangements are shown by the second view. A is the three-way relay, W the winch for raising the ball, J the releasing lever for disconnecting the pawl of the winch when chain D is on the trigger E, F is the hourly signal bell, and G the lightning arrester. On the receipt of the signal current from the observatory clock, the relay coil H is actuated and closes the circuit of the "pilot" coil I. This operates a heavy armature which closes the three



Apparatus Controlling Time Ball.

circuits, of which one operates the releasing trigger J, and drops the ball, another rings the hourly signal bell F, and a third drops a miniature time ball in the principal clock-repairing establishment of Port Louis. The relay coil H, instead of earthing directly is earthed through a second relay at the General Post Office, and this relay in turn gives time to all the district post offices and railway stations.

The time ball line to the observatory is so arranged that on emergency it can be utilised as a duplicate telegraph line.

As a preliminary, at the observatory end, the standard and sidereal clocks were transferred to the magnetic basement, about 80 yards from the main building.

This basement is a subterranean chamber, excavated out of the solid earth, the floor of which is 18 ft. below ground

level. It contains the Milnes seismograph, barograph, magnetograph, and by an ingenious arrangement of double doors, draughts are excluded, and the temperature is kept practically constant by means of the lamps used for photographing the various records, which lamps are continually burning. The building was also cyclone proof, a considerable advantage in this island.

To convey and record the seconds beat of these clocks in their new position it became necessary, first, to equip the

Back View of Recording Dial.

clocks with a suitable contact maker; and, secondly, to provide recording dials of great accuracy to receive these signals and show them in the various computing rooms of the main building.

After many experiments, during which the mercury cup and needle on the pendulum were discarded as unreliable owing to surface oxidation of the mercury, a final solution of the difficulty was arrived at by fitting platinum wire contacts on the anchors of the clock escapements, which dipped every alternate second into insulated mercury cups fixed on the clock frames.

The contact is carefully balanced by a counterpoise on the opposite side of the anchor, so as not to affect the regularity of the clock beats. The mean time clock was also fitted with small contact disks and springs on the second and minute arbors. These close the circuit of the time ball relay every hour, and send the necessary current to the port tower to drop the time ball, in addition to ringing the hourly bell in the main building, thus enabling a check to be kept both on the ball and the recording dials. One of these dials is illustrated herewith (back view), and it will be seen to consist of an electromagnet K operating a simple train of wheels with two pawls on the seconds escapement, which rotate the hands forward every two seconds on receiving the impulse from the clock (anchor contact).

An electrical retarding and accelerating device was also fitted to the mean time clock. This consists of a short permanent bar magnet attached to the pendulum at a point slightly above the centre of oscillation, with its axis parallel to that of the pendulum rod. A magnetising coil is fitted immediately underneath, so that its centre coincides with the centre of the magnet when the pendulum is at rest.

The apparatus is controlled from a small board in the computing room close to the dials, and it is so arranged that when the coil assists the permanent magnet—*i.e.*, when the opposite poles are adjacent, the pendulum moves more slowly and the clock is retarded, and with similar poles adjacent the reverse effect occurs.

The rate of acceleration or retardation can be altered by increasing or decreasing the strength of the battery by a regulating switch, but the average rate used is ·2 of a second per minute, + or −. The effects of this operation are noted and checked on the dials.

Some difficulty was experienced at first in ensuring the regular changing-over of the batteries of agglomerate Leclanché cells (which operated the dial circuits) by means of ordinary switches. To obviate the occasional dropping of seconds and complete discharge of the battery when this switch was forgotten by the attendant, the author devised a commutating clock to do this work automatically. This was constructed with two flat three-section commutators (one for each circuit mean and sidereal), over which a flat brush was rotated. The sections being connected to the three sets of batteries and the brush to the circuit, the batteries were changed over every 20 minutes, thereby greatly prolonging their effective lives.

The clock was weight-driven, and ran 48 hours without rewinding. The sidereal clock, in addition to recording its alternate seconds, also operates a relay which closes a chronograph circuit, operating by a local battery a recording chronograph in the computing room. This instrument acts as a check on the dials, and it further serves to record on a tape the time of transit of stars. It is differentially wound, one coil being operated by the clock contact and the other by a Morse key on the transit instrument, so that at the precise fraction of a second at which a star passes the cross wires of the telescope, the observer presses his key, and a dash is marked on the tape.

A retarding relay is connected in the clock circuit of the chronograph so as to prevent elongation of the second marks and record them as dots, thereby easily distinguishing the two signals. The sidereal current is interrupted for one second in every minute by a small contact breaker on the second arbor of the clock, thus enabling minutes to be distinguished on the tape record.

After the completion of this installation the hourly signals were utilised to distinguish time on the photographic recording drums of the instruments in the magnetic basement, a process which formerly had to be carried out by computation. A small additional relay was connected in the relay circuit of the mean time clock, and on the hourly signal current being received, it closes the circuit of a powerful solenoid. This coil operates an armature attached to the piston of a dash pot, and is so arranged that during the whole time that the armature is raised and descending a contact is made which energises the coils of the aluminium shutters of the instruments, thereby holding these over the slots, and cutting off the light, which prevents the instruments from recording during 4 minutes.

After the armature of the solenoid has returned to its original position, the current to the shutter coils is cut off, and the shutters are replaced by springs. The time of descent of the armature and dash pot is regulated by a small air valve.

This installation of recording dials, &c., is, I believe, the only one in the East, and the whole of the apparatus (with the exception of the releasing trigger, and the recording dials) was constructed in the Colony by workmen who were quite unaccustomed to such delicate instruments, and was practically designed throughout by the author, with the assistance of the Director of the Observatory, Mr. T. Claxton, F.R.A.S., &c., to whose hearty co-operation the success of the scheme is mainly due.

When it is remembered that the clocks were old, and had to be converted to suit the new purposes, and that without impairing their time-keeping qualities, some idea of the difficulties encountered will be conveyed. It is hoped, however, in the near future, to obtain the necessary funds to fit up special master or driving clocks for the dials, and in that case the hourly signals will be sent from one of the mean time dials instead of the clock as at present, which should effect a great improvement.

Electrical Enterprise in Turkey.—The *Financial News* Paris correspondent says that under the auspices of the Deutsche Bank a Franco-German syndicate has been formed, comprising leading German electrical concerns, with the Banque de Paris, Société Générale, the Ottoman Bank, and Swiss and Belgian bankers, with the object of developing the electrical industry in Turkey. The capital of the syndicate will amount to 12,000,000 fr.

U.S.A.—It is rumoured that the Washington, Baltimore and Annapolis Railroad will substitute a direct-current system for its present single-phase alternating-current traction equipment.

PROCEEDINGS OF INSTITUTIONS.

Researches on the Magnetic Properties of a Series of Carbon-Tungsten Steels.

By Thomas Swinden, B.Met.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Sheffield, March 3rd*, 1909.)

The present work deals with the magnetic and electric properties of a series of steels, strictly comparative in every respect. The object has been to investigate steels containing uniformly 3 per cent. of tungsten, with carbon increasing from 0·10 to 1·10 per cent., other impurities being at a minimum.

That tungsten does enormously influence the magnetic properties of steel is, of course, well known. The question of the most suitable tungsten content for permanent magnet steel is, perhaps, a little open to question. The present paper, however, is strictly an examination of a constant-tungsten series, dealing also with the factors governing the permanence of magnets.

The same series of steels have previously been exhaustively examined by mechanical, thermal and microscopical methods, and a correlation of these properties with the magnetic and electric should prove of interest.

The steels were examined in the normal, annealed, hardened and tempered conditions, the latter treatment being performed in three successive stages.

TABLE I.—Analyses of Steels.

Mark.	Carbon. Per cent.	Tungsten. Per cent.	Silicon. Per cent.	Manganese. Per cent.	Sulphur. Per cent.	Phosphorus. Per cent.	Aluminium. Per cent.
924	0·144	3·25	0·044	0·065	0·055	0·010	0·011
922	0·218	3·24	0·050	0·071	0·050	0·010	—
923	0·270	2·92	0·027	0·170	0·014	0·018	—
921	0·480	3·11	0·060	0·075	0·050	0·010	—
981	0·530	3·18	0·033	0·140	0·035	0·012	0·013
920	0·570	3·17	0·078	0·080	0·054	0·010	—
965	0·890	3·08	0·039	0·093	0·040	0·012	—
964	1·070	3·09	0·040	0·055	0·042	0·012	0·014

The bars used were prepared from perfectly sound crucible ingots, $1\frac{3}{4} \times 1\frac{3}{4}$ in., and 25 lb. in weight. After a little cogging, the ingots were rolled down to $\frac{5}{8}$ in. round bars and reeled. With one exception, the preparation was identical throughout the series.

Table I gives the analysis of the steels used. It will be noted that the tungsten contents are very regular, and in every case very nearly approximate 3·0 per cent. With the exception of the carbon, other elements are extremely low and regular.

The steels were examined in four distinct conditions, viz., annealed, normalised, hardened and tempered. The tempering was done progressively, and three stages were examined.

Annealing.—The bars were packed in bone ash in a gas muffle, along with the thermo-element of a pyrometer. The bars were three hours in reaching 950° C.; were kept between 930° and 960° for 90 minutes, and then cooled over about eight hours in the muffle.

Normalising.—The bars were heated very slowly up to 950° C.; were kept about 950° C. for 15 minutes, and then removed from the muffle and cooled freely in the air. The object of normalising is to recrystalise the material and obtain the structure free from possible crystalline distortion or self-hardening effects.

Hardening.—The bars were uniformly heated to 900° C., and were quenched in water, No. 924 at 810°, No. 920 at 780°, No. 964 at 740°, with other bars at intermediary temperatures according to the carbon content. Since the heating was carried out in the Bray-shaw salt bath furnace, no difficulty owing to scaling or uneven hardening was encountered, although the bars were 10 in. in length.

Tempering.—(*a*). The hardening bars, after completion of their examination, were placed, without mutual contact, in an air bath, and kept at between 60° and 75° C. for 14 hours.

(*b*) The above bars were then heated for another 13 hours at 80-85° C.

(*c*) The bars were then packed in asbestos and heated in an electric furnace for 60 minutes at 400° C. and cooled in air.

The magnetic properties have been investigated by means of the Du Bois magnetic balance supplied by Siemens & Halske.

The instrument used was tested and standardised at the Physikalisch-Technische Reichsanstalt, Berlin, and was checked from time to time by means of a standard rod supplied. A diagram is given in fig. 1. The principle of the instrument is, in brief, to measure the tractive force across a gap A of definite dimensions in the yoke of soft iron B, the latter completing the magnetic circuit of which the test-piece C forms part.

This is accomplished by supporting the loose upper half of the yoke eccentrically; the position of adjustable sliding weights D, *d*, when balance is obtained, gives a measure of the tractive force, and thence of the magnetic induction, of the specimen.

The scale E reads directly in values of the induction B. The balance is extremely sensitive, especially with low magnetising forces, and even with the highest values, one can estimate with care, to, say, 50 lines of induction. The apparatus was quite constant, and repeated determinations always confirmed previous ones very closely.

The test bars were machined with spherical ends fitting into holders F with recesses of perfectly similar shape, in order to simplify the correction of the magnetising force H, necessitated by the reluctance of the soft iron yoke and of the air-gaps. A curve, supplied with the instrument, gives the amount by which the observed B-H curve is to be sheared back to give the true values. It is of the greatest importance that the spherical ends of the

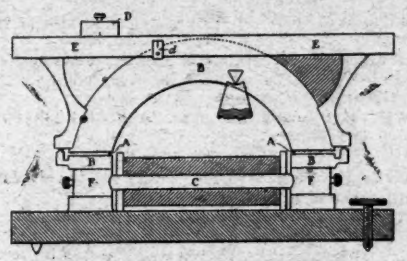


Fig. 1.—Diagram of Du Bois Balance.

bars should fit perfectly into the corresponding recesses in the balance jaws. The ends were tested by covering them lightly with soot and carefully pressing into the recess. A good fitting end comes out quite clean.

The test bars were 25·4 cm. total length and 0·798 cm. diameter, equivalent to 0·5 sq. cm. area.

The ordinary B-H curve and full hysteresis loop with a maximum H = 150 C.G.S. was taken on each of the annealed, normal and hardened bars.

Each bar was magnetised in a field of 150 units, the current was then reduced to zero, and the bar removed from the balance. It was then subjected to shocks by dropping from a height of about 30 in. on to a block of wood, until a constant value of B was reached. When this value for the real permanent magnetism had been obtained, the specimen was demagnetised, and the remanent coercive force thus obtained.

The tempering experiments previously described were then carried out on four representative hardened bars, and the same examination for magnetic properties made after each of the three treatments.

The permanent magnetism of the annealed bars was too low to be measured with accuracy with this apparatus.

Representative steels of each set were also examined with a maximum H of 25, 50 and 100 units respectively.

Explanation of Terms Used.

It is very necessary in any such research as the present one that it should be made clear exactly what is meant by each term used in presenting the results. A note on each of the terms is, therefore, included here.

The Magnetising Force H.—The solenoid is so wound as to give 1 C.G.S. unit of H per centiampere current passing. This observed

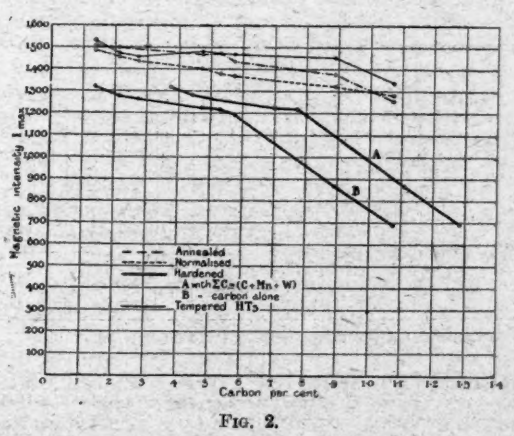


Fig. 2.

value is then corrected for the air gaps in an otherwise continuous magnetic circuit, and for reluctance in the yoke of the instrument, as previously described.

The Maximum Induction $B_{max.}$ is given as the number of lines of magnetic force per square centimetre cross-section of the bar when H = 150. This value is, perhaps, somewhat higher than is necessary for magnetic saturation in the case of some softer specimens, but the same figure, H = 150, was adhered to throughout the series, for the sake of comparison.

The Remanent Induction $B_{rem.}$.—When a magnetising force has been applied and then entirely withdrawn, a certain amount of remanent magnetism still exists in the bar. This value will be designated $B_{rem.}$, and may be defined as the value of B when H = 0 after previous magnetisation.

The Coercive Force H_c represents the value of a negative H necessary to entirely destroy the remanent magnetism. H_c measures the force with which the remanent magnetism is held, and may be defined as the value of H when B = 0 after previous magnetisation.

The Permeability μ is the ratio of the magnetism B induced in a bar to the magnetising force H, to which the induction is due.

Thus $\mu = \frac{B}{H}$.

The Magnetic Intensity I is defined as the magnetic moment per cubic centimetre of the bar, considering the bar to be uniformly magnetised. It has been calculated from the observed value B by the fundamental formula $I = \frac{B - H}{4\pi}$. The intensity, apart from being a truer expression of the magnetic properties of the metal under test, is of primary importance in considering many questions of practical and theoretical interest.

The remanent intensity $I_{rem.}$ has also been reported. It was obtained directly thus—

$$I_{rem.} = B_{rem.}/4\pi.$$

The calculated values of $I_{max.}$ and $I_{rem.}$ will be explained later when considering these values.

The hysteresis loss E represents the energy loss per cubic centimetre per cycle. It is obtained by dividing the area enclosed by the curve for a complete cycle by 4π. The area being taken as a product of B and H, as plotted, gives when so divided the energy loss in ergs.

The Steinmetz coefficient of hysteresis η has been calculated from the formula—

$$E = \eta B^{1.6}.$$

The true permanence value P has been determined, and represents the ultimate magnetic value of each bar, magnetised in a field H = 150, and then knocked about until a constant value is obtained.

A few observations by earlier workers are set out in Table VI.

Considering the results now presented, the following observations may be made:—

As the carbon per cent. increases, $B_{max.}$ decreases regularly in all six sets. $I_{max.}$ is plotted against carbon content in fig. 2. $B_{max.}$ is practically unimpaired by the 3 per cent. of tungsten, even in the quenched condition.

The fall in $I_{max.}$ in quenched steels, as the carbon content rises, has been carefully examined by Benedicks, who suggests "that carbon steel should be non-magnetic, if one could get 1·6 per cent. carbon to remain in the dissolved state, as hardening carbon."

"The dissolved state" for carbon in iron is a somewhat ambiguous term. An ordinary 1·6 per cent. carbon steel consists in its normal state of a eutectic body of Fe_3C and iron (pearlite), with the excess Fe_3C (above 0·9 per cent. C) present as a free constituent (cementite). If this steel be heated to an ordinary hardening temperature, say, 750-800°, the eutectic ground mass is transformed into a solid solution of Fe_3C in iron (hardenite or martensite), whilst the excess Fe_3C is only slightly disturbed. It is this hardenite, preserved in quenched steels, which is by far the most permanent (magnetically), possibly the only real permanent, constituent of steel. A fairly good magnet would therefore be expected, and this is actually confirmed by Mme. Curie, where a steel, C 1·61 per cent., quenched at 750° has, in the state of a bar, $I_{rem.}$ = 370 with a coercive force of 46 units.

TABLE VI.—Some Earlier Results.

Source and treatment.	Analysis.			Magnetic properties.			
	C.	Mn.	W.	$I_{max.}$	$I_{rem.}$	H_c.	E.
	Per cent	Per cent.	Per cent				
Hopkinson, annealed	1·36	0·040	4 65	1,295	884·0	15·30	80,315
" oil hardened... ...	0·51	0·620	3·44	1,154	689·0	47 10	216,864
" "very hard"... ...	0 85	0 310	2·35	968	544·0	51·20	197,660
Curie, quenched, 1,000° C. ...	0·06	0 130	nil	1,560	625·0	3 20	28,000
" " 850° C. ...	0 20	0 150	"	1,590	770·0	7·40	68,000
" " 800° C. ...	0·49	0·240	"	1,525	835 0	19·30	108,000
" " 800° C. ...	0·84	0·240	"	1,230	605·0	52 00	170 000
" " 800° C. ...	1 21	0 210	"	1,200	645·0	53·00	182,000
" "Allevard," not quenched	0 55	0 320	5·52	1,515	900·0	26·00	115,000
" " quenched, 800° C.	0·59	0·320	5·52	1,240	850 0	73 00	280,000
" "Assoilly," " 800° C.	0 76	0·440	2·72	1,240	800·0	69 00	260,000

The value of $H_{max.}$ for Hopkinson is 240 C.G.S.; for Curie 500.

If now the steel were heated to, say, 1,100° for a considerable time the whole of the carbide Fe_3C would pass into solid solution. Quenched from this temperature, practically all the carbon would be preserved in solution, but two constituents would result—martensite and austenite; the difference between these latter two constituents has been attributed to the iron being maintained in two different allotropic modifications. It is this austenite, or solution of carbide in γ iron, which is said to be non-magnetic, and it is to such that Dr. Benedicks refers. But *austenite is never met with in properly hardened steels*, and hence the apparent nil in magnetic intensity for steel with 1 6 per cent. C in the dissolved condition, cannot be correct when the steel is properly hardened.

The *coercive force* is one of the most vital factors governing the magnetic value, and is plotted against C per cent. in fig. 3. Note should first be made that, in the case of the milder steels, the H_c is not greatly improved by 3 per cent. tungsten. This has also been observed by Hadfield, and is of importance from a theoretical standpoint. The effectiveness of the tungsten depends very largely on the treatment. With steels *in the lightly annealed condition, the coercive force is almost identical with comparable carbon steels.* In the normalised state,* again the tungsten has no marked effect. When hardened, however, the effect is made manifest, the H_c being very considerably higher than with carbon steels. It would appear that quenching increases the H_c, even with low carbon,

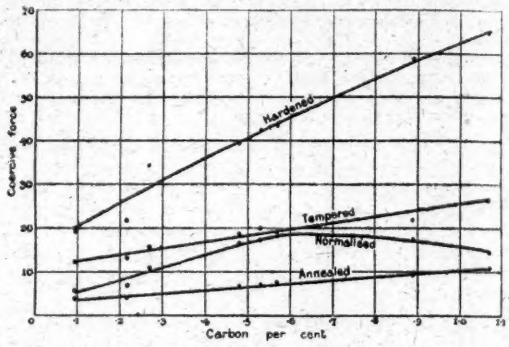


Fig. 3.

although the lowest carbon in this series is certainly appreciable (0·14 per cent.). The tempering up to 80-85° C. had but slight influence, but the tempering at 400° decidedly softened the steels. The B_r reduced to almost the normal value, but an interesting point is that the gradual rise in H_c with the carbon content, shown in quenched bars, is preserved in the tempered.

The normalised set show a distinct maximum about 0·5 to 0 6 per cent. C, but the annealed again show a gradual increase.

According to Mme. Curie, tungsten increases the H_c irrespective of carbon content. The steels are divided into two series; (1) 3 per cent. W, 11 per cent. C, and (2) 5·5 per cent. W, 0 6 per cent. C. The former class has H_c about 70, I_r = 520; whilst the second gives H_c about 72, with I_r = 560. The two are almost identical.

The usual magnet steel, as is well known, is of the latter class; the following analysis by Harbord may be given as typical:—

C 0 62 per cent., W 5·7 per cent., Si 0·09 per cent., Mn 0·55 per cent. Barrett, and others, however, advise the absence of manganese.

It is clear that class (1) above is much cheaper in production than (2). The author must admit, however, that the figures quoted above have not been reached by the 3 per cent. W steels in this work. In any case the real permanence is found to be at a maximum with about 0·5 per cent. C, being a resultant effect of H_c on the remanence. Molybdenum steels will, no doubt, compete with tungsten steels as permanent magnets, so far as one can judge from the scanty data available.

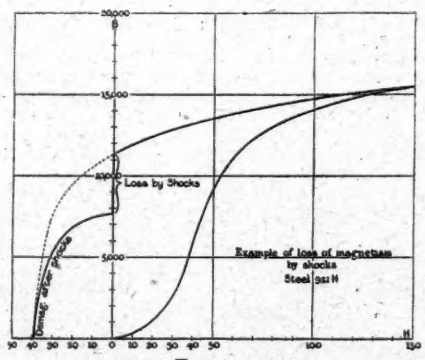


Fig. 4.

Permanence.—This property has been carefully examined regarding both ordinary remanence and real permanence.

Arnold attacked the question of permanency with characteristic vigour. The following important observation was made:—"In iron containing 0·1 per cent. to 0·9 per cent. carbon (quenched) the permanent magnetism is directly proportional to the sub-carbide of iron present." In other words, hardenite alone holds permanent magnetism.

Mme. Curie made this subject one of the chief subjects of her much quoted paper. In general the loss by shocks is less, as the coercive force is greater. "However, the intensity also has an influence, and with H_c equal, the loss *per cent.* by shocks appears to be greater as I is greater." The coercive force is unaltered by shocks, and an interesting observation is that, in general, the most permanent magnet requires the least number of shocks to bring it down to the permanent value.

* None of the steels of this series are appreciably "self-hardening."

If the bar be demagnetised to the previously determined permanence, shocks have no further effect. If partially demagnetised towards this value, shocks only bring it down to the former permanence. Again, if demagnetised to beyond the permanence, the tendency is to recover with time.

The coercive forces before and after shocks are identical, except, perhaps, for very low values of permanence (fig. 4). The permanent I after shocks is plotted against carbon content in fig. 5. The annealed steels gave permanence values too low for accurate reading.

The normalised steels show a marked maximum, about 0·6 per cent. carbon, and *the hardened steels present a decisive maximum value, about 0·45 per cent. carbon*, notwithstanding that the coercive force increases regularly (fig. 3). The tempered bars give values much lower than hardened, and show no maximum point within the range examined.

Although the hardened steels show a maximum in permanent intensity, the ratio of permanent to remanent increases regularly with carbon (and coercive force), as would be expected. This led naturally to a consideration of the factors governing the permanence (P), and the ratio $\frac{I_{permanent}}{I_{remanent}}$ plotted against H_c gives as result a straight-line curve.

Heating for a prolonged period about 60-70° C. is generally advised for making a magnet permanent. In this way one gets down to the practically permanent value. Curie has shown that 25 hours at 60-70° C., after magnetising to saturation, does not lower

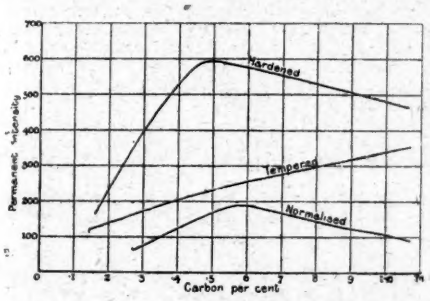


Fig. 5.

the H_c more than 3 per cent.; whilst after treatment at 100° the loss is 12-13 per cent., and loss to $I_{rem.}$ about 6 per cent. Barus and Strouhal advise as follows:—

Heat the bar, say, 24 hours at 60-70°, magnetise, and re-temper whilst magnetised, thus feebly demagnetising the bar.

Mme. Curie prefers to demagnetise to the extent of one-tenth the remanence, in place of the second tempering, although this latter treatment in addition can do no harm. A magnet prepared in such a way has a definite temperature coefficient.

Osmond advises: (1) Heat to just below the critical temperature after forging, (2) machine, (3) quench from just above the critical temperature, and (4) temper at 100°.

Experiments concerning tempering and also partial demagnetising have been included in this research. The permanence is reduced some 10-15 per cent. by the combined tempering. Several demagnetising experiments were made, of which the following are typical: Steel 920 H, after magnetising in a field H = 150, gave $B_{rem.}$ = 10,870, and P = 7,000 with H_c = 42·9. Demagnetised in a field of 34·5 units (after remagnetising to full), $B_{rem.}$ = 6,590 and P = 6,810; H_c = 43·1. Again magnetised to full, and demagnetised to $B_{rem.}$ = 6,865, and after shocks P = 7,080.

Similarly with steel 965 H. After magnetising $B_{rem.}$ = 7,330, P = 6,490, and H_c = 59·2. Demagnetised in a field H = 28·5, $B_{rem.}$ = 5,650; after shocks P = 6,660 and A_c = 59·6.

It will be seen that the definite value for the permanence is obtained in every case, and that the coercive force is uninfluenced by these demagnetisations.

From the foregoing it would appear that there is apparently a definite constant value for every magnet, and the different treatments advised are just those considered easiest and surest methods of getting there.

Tempering is useful in relieving stresses, both physical and magnetic, caused by quenching. The idea to demagnetise one-tenth of the remanent covers the sub-permanent remanence, but is probably a little more than is strictly required in many cases.

All forgings should be reheated (or even recrystallised by "normalising") in order to relieve forging stresses—even though the piece may be re-heated again afterwards for hardening.

Quenching at the correct temperature is of at least equal importance to the magnetic qualities, as to the hardness and strength—say as a tool. In the case of steels containing 0·9 per cent. carbon and above, the quenching temperature should be in the neighbourhood of, say, 730°-740° C. Before quenching, however, the steel should have been heated somewhat higher. In a steel with 1·1 to 1·2 per cent. carbon, about 850-900° would serve well; by this means the excess cementite is at least changed from the form of dangerous cell wall membranes to harmless specks.

With lower carbon content than 0·9 per cent., higher quenching temperature as the carbon falls tends to give a more uniform structure, and, as shown by Curie, a 5 per cent. C steel gave best results quenched from 900°, and 0·06 per cent. C steel when quenched from 1,000°.

An examination of the fracture of a few trial quenchings constitutes a reliable guide in this direction.

The statement so often made, that a steel which is physically hard is also "magnetically hard" (*i.e.*, high H_c and $I_{rem.}$), is in certain circumstances broadly correct.

Work carried out in 1895 showed that it was just those elements (Al, P, As and Si) which increased the size of the crystals of iron, which also increased the permeability and lessened the hysteresis loss. Many points are in favour of this explanation—annealing increases the size of crystals, quenching lessens.

One of the most interesting points is that concerning the tempered bars. The magnetic tests showed a tremendous increase in permeability caused by tempering. Yet the *crystalline structure is practically unaltered.* The constitution within the crystals is entirely changed, and this must be mainly responsible for the increase in permeability (and decrease in coercive force).

Arnold showed, in the case of carbon steels, that *hardenite—a constituent*—was the governing factor of permanence. Whether the tungsten acts through forming an alloy with the iron or by action through the carbon is not quite clear. The latter view is favoured by Hadfield.

It may be that the permanence is governed by *constitution* and permeability by *crystallisation*, but many facts point to the latter being of secondary consideration in both cases.

Discussion.

Prof. McWilliam, in opening the discussion, said he agreed with the author that austenite was never met with in properly hardened steels, and hence the apparent nil in magnetic intensity for steel with 1·6 per cent. carbon in the dissolved condition could not be correct when the steel was properly hardened. A ·6 per cent. carbon steel, or any steel well under 0·9 per cent., or its equivalent, made the best permanent magnet. It was very interesting to see that the quenching temperatures from the magnetic point of view were similar to the ordinary temperatures for tool steel. Regarding the relative crystalline structure being unaltered, as mentioned on page 27, that was visually only. As more perfect objectives were used, more of the so-called sorbite must be classed as fine pearlite, and the remaining sorbitic constituents were pearlite, only at present beyond the power of the microscope to resolve.

Dr. W. M. Hicks said they wanted to know what was the mechanism which at the same time increased rigidity, and gave the property of being hardened and being permanently magnetised. Those materials which conferred high permeability on a steel were those which enabled it to crystallise with large crystals. The hardening substances reduced the size of the crystals, but it was difficult to see how making the crystal smaller should make the rigidity or the hardness greater. The effect must be molecular. The probability was that the same thing which caused the crystals to be smaller prevented the constituents from separating out, and that the small crystals contained throughout their substance some of the hardening substance: that they were not composed, in fact, of practically pure iron, as in the case of the largest and more slowly formed crystals.

Mr. H. E. Yerbury asked whether it was not possible, in all steels used for permanent magnets, to have a constant carbon content with a varying percentage of tungsten.

Mr. Percy Longmuir said that steel makers usually supplied a steel for permanent magnets containing about 0·60 per cent. carbon and about 6·0 per cent. tungsten. In practice this was considered to give better results than a steel containing 1·0 per cent. carbon and 3·0 per cent. tungsten.

Mr. H. Brearley said that the reason why steel containing only ·6 carbon, and 5 per cent. tungsten was preferred by magnet makers rather than steels of higher carbon and lower tungsten, might be the fact that the lower carbon and higher tungsten, were considerably easier to work than the higher carbon and lower tungsten steels. In the manufacture of complicated magnets, such as were seen in table telephones, the ease with which any particular type of steel could be forged, was of considerable importance. Steel makers did not send this high tungsten steel, because they preferred to send it, but because the maker of magnets required it. Generally speaking, the higher the temperature to which the steel was raised, the larger became its crystalline structure, but it was possible to effect the perfect solution of the carbon or diffusion of the various microscopic constitutents in the annealed state at a much lower temperature than 900° C. According to the lecturer a temperature of 900° C. would be required in treating magnets, whereas any tools made from the same steel would be hardened at a much lower temperature; from which they might conclude that their experience in tool hardening was not directly applicable to magnets. He had been informed by makers that it was not possible in our own country to purchase as good a magnet as they got abroad, although the steel used both here and abroad was practically identical. This would suggest that they did not sufficiently understand all that was involved in the actual manufacture of magnets.

Mr. A. J. Cridge said the accuracy of measuring apparatus depended to a vital extent on the magnets used in its construction. It was not advisable for a central station engineer to attempt to alter the strength of the magnets he used; it was much better to get new magnets, suitable for the purpose in hand, from a reliable manufacturer.

Mr. J. W. Beauchamp said a magnet might rise in temperature from 60° to 100° F. once or twice every 24 hours, and it would be interesting to know whether this would have any effect on the permanency of its magnetism.

Mr. T. Middleton said as regarded the orders for magnet steel

going out of the country, the magnet makers asked for the best steel, but they did not offer to pay the best price. If they would pay the price, he felt sure the best possible could be produced in Sheffield. In testing steels for permanent magnetic properties, he had always found that the general magnetometer method was the most useful commercially. He had not been able to repeat results accurately. If they took a steel and treated it in a certain way, then repeated the experiment, the general results would vary considerably. In the paper the temperature treatment at about 600° was called tempering, and also higher heatings were called tempering. This very low temperature treatment (in order to drop the sub-permanent magnetism) was precisely similar treatment to that which was bestowed on other hardened materials in Sheffield, which operation was better described as "ageing." After this treatment a hardened steel would not show any appreciable annealing back.

Mr. Pettifor said he had found that if a magnet was aged or tempered as in division (*a*), and then allowed to rest and again aged, there was a continual drop in the remanent magnetism, even showing after the magnet had been aged four or five times and allowing a period of rest between each test.

Prof. Crapper said the author suggested that permanence was governed by constitution and permeability by crystallisation. His opinion was that it was just the reverse. The idea of susceptibility explained why the part of the curve between the point of remanance and the point giving the coercive force was nearly straight, for at this part of the process of magnetisation the material was more susceptible to magnetism than at any other.

Mr. J. W. Ullett said that the question of the permanence of a magnet was a very important matter to telephone makers. The exposure of magnets to heats varying up to 100° C. gradually reduced the strength of the magnet to a permanent condition. The excellent results obtained by sparking magnetos of high-class construction were not entirely due to the strength of the magnets. The excellence of the workmanship was a more important factor. In some high-class sparking magnetos that he had examined the actual armature clearance was between ·002 in. and ·003 in. The magnets they were using, made from Sheffield steel, compared very favourably with these sparking generator magnets. There was no doubt that this paper contained most valuable results, and he must congratulate the University on providing means for investigations such as this, and also on training men to apply those means. It was only by investigations such as these that they could hope to keep ahead of their friends abroad.

Mr. S. N. Brayshaw (Manchester) said the author spoke of the bars being uniformly heated to 900° C., and then quenched in water from 810°, 780° C., &c.; he took it that they were first raised to the maximum temperature and then lowered gradually to the various temperatures given, and finally quenched in water. He would like to know the length of time that was spent on these operations; how long at the maximum temperature; how long in cooling, and how long at the lower heat, for these particulars were a great deal more important than was usually supposed. It was probably as true of the hardening of magnets as it was in the case of tools, that it was easy to accomplish ordinary good hardening, but considerable accuracy was required for the best hardening, and the difference between the good and the best was very great. He had hardened thousands of magnets, and knew that the magnetic properties were profoundly affected by the method of hardening. He had also known magnets to be very different after they had unquestionably received the same hardening treatment, and this was doubtless due to some previous treatment.

Mr. Victor Stobie said a certain steel of given composition would have different magnetic effects varying with the heat treatment. The structure depended upon the particular combination of the elements within the steel, and therefore it might be that all the effort of the steelmaker and hardener was to get a particular carbo-tungstate of iron. It was remarkable that they got results with high tungsten and low carbon steel nearly the same as with high carbon and low tungsten. In view of the permanence of a Simms-Bosch magneto, a friend of his tested the hardness of the steel, and the results showed remarkable softness. These magneto machines were world famous for their retentiveness. The steel was made in Germany, and the apparatus was made in Paris. The Germans supplied the steel at a price against which English people could compete with their usual magnet steel; therefore, they ought to make a deep research into each particular steel under different conditions of heat treatment, because it would seem, for the Simms-Bosch magnet to be in that soft condition and to be cheaper steel, that it could not contain the high tungsten that the English magnet steel contained. The magnetic properties must be mainly the result of the combination within the steel caused by the treatment it had received. A local firm that supplied magnet steel for electrical instruments invariably hardened their magnets before sending them out, and there was no further treatment. The magnets were given to a file hardener, and he treated them as he would ordinary files. They received no complaint as regarded difference in permanence, and the magnetic field was practically the same in every magnet. These magnets were supplied largely for delicate galvanometers.

In reply, Mr. T. Swinden said he had not met with either carbon or carbon-tungsten steel which was non-magnetic. The maximum permanence value with a carbon content of only 0·5 per cent. C. was due to the permanence being a resultant effect of coercive force and remanent intensity. In the preliminary quenching experiments, the object was to find the treatment giving the finest structure. Quenching at temperatures either above or below those adopted gave inferior results in this direction. The suggestion from Dr. Hicks that the magnetic properties be correlated with the coefficient of rigidity was most valuable. An interesting point was that the elastic ratio (*i.e.*, elastic limit to maximum stress) was 20 to 30 per cent. higher for the carbon tungsten steels than for carbon steels in the normalised condition. He was exceedingly pleased to hear Dr. Hicks's statement that the effect of the special element must be molecular. Substituting "constitutional" for "molecular," the statement strongly supported the proposition that the actual crystalline structure was of secondary importance. Although the higher tungsten steel was now preferred in practice, it was possible that, by judicial treatment the 3 per cent. steel could be made to compete. In reply to Mr. Brayshaw, bars for hardening were first normalised, and then on hardening, the eight bars were placed in the salt bath at 900° C. After five minutes, the furnace was allowed to cool and the steels quenched out in water at about 18° C. at temperatures indicated on page (3). The time in cooling from 900° to the last quenching would be about 20 minutes. There was no doubt that, to obtain the best from the steel required careful trial and very considerable skill in treatment. Mr. Stobie had not appreciated the point of the paper; it was evident that he had considered remanent intensity only. One of the main features of the research was to show that the size of the crystals was not necessarily a prime factor. He could scarcely associate himself with Mr. Stobie's depreciation of accurate hardening for magnets. The higher carbon steel no doubt required more care in forging, but current practice in many forges showed that this factor could scarcely furnish justification for the preference. It was evident that the difference between *treating* and *hardening* had not been realised. A quenching temperature of 900° C. had never been advocated for tool steel. What was advocated was a short heating at an initial temperature of towards 900°, followed by quenching just above the critical point. In reply to Mr. Beauchamp, if the magnet were used just as hardened, the small rises in temperature would eventually have an effect, bringing down the efficiency to definite constant value. Had the magnet been prepared by heating, for, say, 30 to 40 hours at 100°, together with a slight demagnetisation, such temperature rises would be without effect. The term ageing was almost universally used in describing the gradual deterioration of the soft iron for transformer cores, &c., accompanied by *increase* in hysteresis loss. The treatment for the removal of sub-permanent magnetism, giving a *decrease* in hysteresis loss would appear to be of an entirely different order.

THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

Several New Cable Factories Reported in Germany.

An interesting item appears in the report for 1908 of the Schaafhausen Bank Verein in relation to the origin of the German South American Telegraph Co., which is engaged on the establishment of a cable connection with Brazil and with the German colonies in Africa. The Bank states that it has devoted special attention for a long time past to the creation and extension of submarine cables, and that, at the instance of the German Imperial Post Office, it formed the company in question in conjunction with allied banks and firms.

The German Transmarine Electricity Co., which is interested in lighting and tramway enterprises in Buenos Ayres and Santiago, has just offered for subscription £400,000 in new shares, the issue of which was sanctioned at the recent extraordinary meeting. The present proprietors have had the opportunity of taking up the emission at the rate of 125 per cent., or £62 10s. per £50 share, instead of the whole block being placed with a syndicate at the rate of 120 per cent. At the meeting it was stated that the dividend for the past year would be 9½ per cent., as in 1907, and the prospect was held out of a similar distribution being made for 1909 on the share capital of £3,600,000, whilst the new issue of £400,000 would participate to the extent of one-half the rate of dividend.

The ordinary capital of the Electrical Enterprises Co. (Gesellschaft fur Elektrische Unternehmungen) is to be increased from £1,875,000 to £2,250,000 by the emission of new shares. The company is practically an investment concern, and the shareholders, contrary to the practice followed on the previous augmentation in 1905, are to be given a preferential right of subscription. An addition to the banking firms supporting the company is to be made on the present occasion by the inclusion of the Deutsche Bank.

The liquidation of the Helios Electricity Co., whose manufacturing works were purchased a few years ago by two of the leading firms to prevent their again becoming a competitor, has not yet been brought to a conclusion. Neither has the winding up of the Union Elektrizitäts Gesellschaft, whose undertaking was absorbed by the Allgemeine Elektrizitäts Gesellschaft, yet witnessed a termination.

German Works.

The report of the Kabelwerk Duisburg (Duisburg Cable Works) states that satisfactory employment was experienced during 1908, and important orders were again received from local authorities. As a result of the extension of the works it was possible to comply with rapid conditions of delivery also in the case of large orders, but prices further declined during the year. At the present time business in internal wiring conductors is directly unprofitable. The company placed its insulating material on the market in

December, and it has received a very good reception. A severe depression in prices has recently occurred in consequence of the establishment of several new cable factories, and the directors deem it appropriate to create a dividend equalisation fund out of the profits for the year. After providing £9,930 for depreciation, as compared with £15,000 in 1907, the accounts show net profits of £12,580, as contrasted with £10,350 in 1907. It is proposed to pay a dividend of 10 per cent. on the share capital of £75,000, being the same rate as in 1907, and to place £3,000 to a fund for equalising dividends.

The report for 1907-8 of the Telephonfabrik Gesellschaft (late J. Berliner), of Hanover, refers to the increase in the share capital from £150,000 to £200,000, nearly one-half of the addition being devoted to the acquisition of the telephone and telegraph works of R. von. Lieben, at Olmutz. During the year the new factory at Buda-Pesth was started, and the expected Government orders had been received. The company's turnover was 20 per cent. greater than in the preceding year, and the net profits reached £22,346, as compared with £20,726 in 1906-7. A dividend has been declared at the rate of 10 per cent. on the £150,000 of capital entitled to participation for the year, this being the same rate as in the previous 12 months. The financial interest in subsidiary undertakings has been reduced from £117,000 to £47,000.

The Fabrik Isolierter Drähte (Insulated Wire Works Co. late C. J. Vogel), of Berlin, experienced a decline in the orders in the first half of 1907-8, and the depressed sale prices also influenced the working results, although the cost of production was reduced by the cheapening of raw materials. The net profits amounted to £2,883 as contrasted with £5,061 in 1906-7, and a dividend has been declared at the rate of 3 per cent. as against 6 per cent. in the previous year. It is mentioned in the directors' report that the manufacture of wires covered with a lacquered material has not corresponded to expectations, although it is now hoped that the experimental stage has been passed, and that the utilisation of the patent for the production of coils of bare aluminium wire has also not yet had the desired result.

The E.H. Geist Electricity Co., of Cologne, delivered 1,119 machines and transformers of a total of 12,364 H.P. in 1907-8, and the turnover increased by 20 per cent. in the first half, but could not be kept on an adequate level in the concluding portion of the year. The gross profits amounted to £15,460, as compared with £18,390 in 1906-7, but these were wholly absorbed by general and working expenses, and provision for depreciation, which were greater than in the preceding year; and after appropriating the reserve fund, the accounts show a loss of £6,850, which has been carried forward. This compares with net profits of £5,450 in 1906-7, when a dividend of 8 per cent. was paid on a capital of £55,000. Since the report was issued, the directors have announced that owing to the demands made upon the company's liquid funds by the change in the condition of trade, it will be necessary to reduce the share capital, and make an emission of preference shares.

The Gesellschaft für Elektrische Industrie (Electrical Industry Co.), of Carlsruhe, Baden, which for eight years has been unable to distribute any dividend, was equally unsuccessful in 1907-8. An unfavourable reaction had been produced by previously forcing the construction of turbines, the stocks had to be written down, the gross receipts declined from £34,700 in 1906-7 to £3,100 last year, and the trading resulted in a loss of £4,200, as against a profit balance of £700 in the preceding year. Special provision for depreciation had to be made, which had left a deficiency of £22,000, whilst the sale of three central stations had caused a further book loss, and raised the deficit to nearly £30,000 on a share capital of £70,000. The new financial year had opened with a reorganisation of all the company's departments for the purpose of reducing the expenses.

Swiss Works.

The report of the Swiss firm of Brown, Boveri & Co., which is associated with the Berlin Allgemeine Co., states that the financial results in 1907-8 were greater than in the preceding year, but the expenses and provision for depreciation absorbed larger sums. The net profits reached £94,070, as compared with £87,080 in 1906-7, and a dividend of 11 per cent. has been declared, being at the same rate as in the previous year. In addition to the existence of bonds of £400,000, the company has an ordinary share capital of £800,000, of which the sum of £640,000 has participated fully in the distribution, whilst the balance of £160,000, representing new capital, has shared in the dividend to the extent of one quarter. It is mentioned in the directors' report that the turbine engines delivered to the German Navy by the Turbinia Co. emanated from the Swiss company's shops, and that they had helped to pave the way towards the general employment of this type of engine in the navy. The Swiss Federal Railway Administration took over on July 1st, 1908, the electrical installation established in the Simplon Tunnel, but, notwithstanding the sale, the experiment had resulted in a considerable loss to the company. An increasing turnover was being effected by the London company established under the same name. The report adds that, as far as could be seen, the Swiss works would remain fully occupied in the current year, and the cheaper sale prices would be partly compensated by the lower cost of raw materials.

The report of the Oerlikon Machine Works Co. for 1907-8 states that all departments were well employed, although the demand became somewhat slack by the end of the year. Satisfactory results were obtained with the experimental section for electric traction between Seebach and Wettingen, and the working had afforded a practical proof of the suitability of the single-phase system for this purpose. The steam turbine branch provided a considerable amount of work, and repeat orders were obtained from various electricity works. The shops for the construction of small motors, electro-mechanical appliances and lighting apparatus were completed in the second half of the year, the new erecting shop was also equipped, and a new building was established for the production of apparatus. The foreign companies in which the company is interested, and which use its products, yielded satisfactory results, and the same observation applied to the engineering offices in Stockholm, London and Zurich. As net profits the accounts showed the sum of £17,894, as contrasted with £14,587 in 1906-7, and a dividend of 4 per cent. has been declared, being the same rate as in the previous year, on an ordinary capital of £320 000. The number of officials and workmen employed at the end of the year was 2,769, as against 2,602 at the close of 1906-7.

The Alioth Electricity Co., of Basle, realised gross profits of £42,900 in 1908, as compared with £35,140 in the preceding year. After making provision for depreciation and other items, the balance allows of the payment of a dividend of 6 per cent. on the £120,000 of priority capital and 6 per cent. on the £120,000 of ordinary shares, these contrasting with 6 and 4 per cent. respectively in 1907. The directors' report refers, among other matters, to high-speed alternating-current motors as a speciality for the driving of centrifugal pumps, and numerous contracts are on hand for their supply to local authorities. During 1908 the company delivered transformers of an output of 90,901 KW. and dynamos and motors of 130,051 H.P., as against 76,594 KW. and 133,369 H.P. in the previous twelve months.

PARLIAMENTARY.

Preston, Chorley and Horwich Trams.—On Thursday of last week this Bill came before the Unopposed Committee of the House of Commons (Mr. Emmott presiding). The Bill asks for powers to extend the period for the construction of certain works authorised under the company's Act of 1903. It is also sought to reduce the share capital from £500,000 to £425,000, and the loan capital from £125,000 to £106,250. The company may issue any portion of the capital not exceeding £200,000 as preference shares, bearing interest not exceeding 6 per cent. per annum. Power is also sought to enter into an agreement with the Corporation of Bolton for a lease to the company, or for the purchase by the company of so much of the existing tramway belonging to the Corporation as is situated in the township of Horwich. Under Clause 30 further powers are asked for supplying electricity in bulk to any corporation, local authority or person requiring the same and being upon the route traversed by the tramway. The Parliamentary agent for the Bill gave formal evidence, and stated that the company had taken out of the measure the clause which provided for running powers over the tramways of the Corporations of Bolton, Preston and Wigan, by agreement with the corporations. The Bill was ordered to proceed.

North-West London Railway Bill.—On March 30th the Court of Referees considered the objection raised by the promoters to the Great Western Railway having a *locus* in respect of the above Bill. After private consultation the Court granted a *locus* against Clause 5.

Dudley Corporation Bill.—This Bill was before Lord Onslow's Committee on Unopposed Bills on Tuesday, March 30th, and formal evidence having been given, the preamble was declared proved. The Bill enables the Corporation to grant leases of any tramways belonging to them, including the tramways and light railways acquired, or to be acquired, from the British Electric Traction Co., Ltd., the Dudley, Stourbridge and District Electric Traction Co., the Birmingham and Midland Tramway Co., the Wolverhampton District Tramways Co., and the South Staffordshire Tramways Co.

Second Reading.—In the House of Lords on March 31st, the North Metropolitan Electric Power Supply Bill was read a second time.

LEGAL.

Postmaster General v. National Telephone Co.

In the House of Lords on Friday, April 2nd, an important judgment was given by the Lord Chancellor, the Earl of Halsbury, and Lords Macnaughton, Collins and Gorell, in an appeal by the Postmaster-General in an action brought by him against the National Telephone Co., Ltd., in whose favour the Court of Appeal had decided the questions raised in a special case which was first considered by Mr. Justice Swinfen Eady.

These questions involved the decision as to the extent of the monopoly enjoyed by the Post Office by virtue of the Telegraph Act of 1869. Sec. 4 of that Act provides that the Postmaster-General by himself or by his deputies, servants, and agents shall have the exclusive privilege of transmitting telegrams within the United Kingdom and performing all the incidental services of receiving, collecting and delivering telegrams in the United Kingdom, certain description of telegrams being, however, excepted by Sec. 5. Among these exceptions are: (1) Telegrams in respect of the transmission of which no charge is made transmitted by a telegraph maintained or used solely for private use and relating to

the business or private affairs of the owner thereof; and (2) Telegrams transmitted by a telegraph maintained for the private use of a Corporation, company or person, and in respect of which, or of the collection, receipt and transmission or delivery of which, no money or valuable consideration shall be, or promised to be, made or given.

It will be remembered that it was decided in the case of Attorney-General *v.* Edison Telephone Co. (6 Q.B.D. 244) that a telephone is a telegraph within the meaning of the Act, and therefore that the provisions in the Telegraph Act, 1869, as to telegrams applied to telephones just as if the latter had been mentioned by name. The National Telephone Co., Ltd., hold a licence for 31 years from January 1st, 1881, granted in 1884 by the then Postmaster General, to work and use telegraphs of which the transmitting and receiving instruments are telephones for the purpose of enabling persons to communicate with one another by means of spoken words, and a royalty of 10 per cent. is payable to the Post Office on sum received. Part of the defendants' business is the supply and maintenance in consideration of annual payments of telephonic lines and instruments and appliances constructed between two places for the purpose of affording communication between those two places alone. Such lines when once erected are maintained by the company, but are worked and used independently without the intervention of any servant of theirs. Among the instances given in the special case were lines between different places of business where allied trades or professions were carried on, lines connecting fire brigade stations with other buildings such as a warehouse, a theatre and a workhouse, and lines connecting the theatrical ticket agency of Keith, Prowse and Co., Ltd., with a number of theatres, and also with a number of hotels. In each case the agreement with the defendants was executed, and the rent paid by one only of the two parties so connected by the defendants' line, and the first of the questions submitted to the Court was whether in respect of their lines the defendants were liable for the royalties under their licence, or whether the telephones in question did not fall within the first exception to the plaintiff's privilege, since the owner or person paying for the line was maintaining it solely for his business or private affairs. The second question related to wires which connected boxes placed in the street by a municipal corporation with a fire station, and wires connecting electric bells between places to give notice of such things as the staring of a tramcar to members of a golf club and the like, but to which no telephone was attached. No question, therefore, arose under the licence, the point in that case for decision being whether the company by supplying and maintaining lines and apparatus of such a character, were contravening the plaintiff's privilege under the Act of 1869. The learned judge held against the company on both questions; but the Court of Appeal reversed his decision on the first question, holding that the exception applied in favour of the company. The Postmaster-General appealed.

The appeal was first argued in November last before the House, consisting of the Lord Chancellor, Lord Macnaghten and Lord Robertson. Judgment was reserved, but as Lord Robertson died before the decision was given, and there must be three noble and learned lords who deliver judgment in order to form a minimum quorum of the House, the case had to be reargued. The rehearing was concluded on March 22nd, and again judgment was reserved.

The Attorney-General, the Solicitor-General and Mr. Casserley (instructed by Sir R. Hunter) appeared for the Crown; Sir Robert Finlay, K.C., Mr. Danckwerts, K.C., and Mr. H. H. Gaine (instructed by Mr. William E. Hart) for the company.

The Lord Chancellor read the following judgment: My Lords—With the utmost respect for the Court of Appeal, I am unable to accept their view. This appeal affords an admirable illustration of the danger to which great interests in this country are exposed by the slovenly manner in which even Public Acts of Parliament are expressed. It is still worse with Private Acts. In the present case the Government bought the telegraphs and acquired a monopoly of telegraphic, which includes telephonic, communication, about 40 years ago, for a great sum of money. And to-day your Lordships have to consider how far that monopoly extends, not in regard to trivial and frivolous invasions, but in regard to claims so far-reaching that if admitted they would go a considerable way towards destroying the value of the monopoly itself, and so serious as to have been admitted by the Court of Appeal. Speaking generally, not with complete precision, the National Telephone Co. allege that the statutory monopoly of the Postmaster-General is limited by Sec. 5 of the Telegraph Act, 1869, so that any person (corporate or individual) may without licence use his own private wire to communicate with any other persons, however numerous, provided the message relates to his own business, and is transmitted without charge. On the other hand, the Postmaster-General says that such a private wire can only be used by its owner to transmit messages to and from himself and his own servants and agents, except for occasional gratuitous use by others of an exceptional kind. The point is conveniently, though roughly, expressed in the question—"May a person use his private wire to send A to A messages (that is from himself to himself), or can he also use it to send A to B messages?" Which of these views is sound must depend upon the true meaning of two paragraphs in Sec. 5 of the Act of 1869, which undoubtedly create exceptions to the monopoly granted by the preceding section. I propose to consider each paragraph separately. The first excepts from the monopoly:—"Telegrams in respect of the transmission of which no charge is made, transmitted by a telegraph maintained and used solely for private use, and relating to the business or private affairs of the owner thereof." Here are laid down definite conditions under which alone this exception applies. No charge must be made by the owner of the "telegraph" for transmitting a message. The message must relate to his own business, though, of course, it may also relate to the business of other people. And finally, the telegraph must be maintained or used solely for the owner's private use. The singular is employed. It is one owner, not several; one personality, whether corporate or not. I think this means that the owner alone can use the telegraph. It cannot be said to be used solely for his private use if the wire is at the owner's office at one end, and at the other end, or at a multitude of places throughout its length, it is at the offices of other people also, who are not his agents or servants. In that case it is used not solely for the owner's private use, but also for that of others. The main argument of the respondents was that if that be the sound construction, there was no need for saying that no charge should be made, for no one would charge himself. I cannot appreciate this argument. A message may be sent by A to his own agent relating to his own business, and it may also relate to B's business; and B may be willing to pay something for getting the message sent and the answer communicated to him. That is the reason for prohibiting any charge being made. I now come to the second paragraph which excepts "Telegrams transmitted by a telegraph maintained for the private use of a corporation, company or person, and in respect of which, or of the collection, receipt and transmission, or delivery of which, no money for valuable consideration shall be, or promised to be, made or given." This paragraph is differently worded, because it deals with a different case. Here there is no condition that the messages must relate to the owner's business. Here, also, it is not imperative that the "telegraph" shall be "maintained or used" solely for the owner's private use. It is enough that it is maintained for the private use of the corporation, company or person, and no charge made. It seems to me that the design was to allow a third person to use the telegraph, and to use it for business in which the corporation, company, or person had no concern, provided that the message was sent gratuitously, and that the telegraph was maintained for the private use of the corporation, company or person. In other words, if the real purpose of maintaining the telegraph was for that private use, outside persons might be allowed to use it for their own affairs always on terms of no charge being made. The Attorney-General described this as a casual and gratuitous use. I think he is right. If the practice were frequent, then the privilege would be destroyed, for then it might truly be said that the wire was not maintained for the private use of the corporation, company or person only, but for the use of the other persons also. The language of both paragraphs is clumsy, and the two are not mutually conclusive. But in substance the later is a qualification of the earlier, intended to allow a certain degree of latitude. There may be an occasional invasion of the monopoly, but it must not be a practice. This concludes the case in favour of the appellant. I need not, therefore, deal with the Attorney-General's second contention that, under the agreement, the National Telephone Co. are bound to pay the disputed royalties quite apart from the statute. In my opinion, the agreement in this particular merely licenses what would without licence be prohibited by the statute. A point was made that the transmission of a signal, as described in the second schedule, does not amount to the transmission of a telegram within the Act of 1869. I think the point is untenable in view of the definition clause.

The Earl of Halsbury: I entirely concur in judgment of the Lord Chancellor, and with the reasons on which it is founded.

Lord Macnaghten: My Lords, I agree.

Lord Collins: My Lords, I concur.

Lord Gorell: I also am of opinion that the appeal succeeds.

The appeal was therefore allowed.

The Crown asked for costs.

The Lord Chancellor: Is it not the practice that the Crown neither gives nor receives costs?

Sir Robert Finlay, K.C., for the respondent company, explained that while there was no definite rule, their Lordships had often declined to grant the Crown costs in a successful appeal, and had always, so far as he was aware, treated the matter as one of discretion. He asked in this case that no order should be made.

After some discussion, the Lord Chancellor said this was a case in which their Lordships thought the Crown was entitled to costs. Order accordingly.

Blackpool and Fleetwood Tramroad Co.—Rating.

In the House of Lords on the 1st inst. judgment was delivered in an appeal by the Thornton Urban District Council from an order of the Court of Appeal in favour of the respondents, the Blackpool and Fleetwood Tramroad Co., which raised a question of tramway rating.

The Court of Appeal, reversing a judgment of the Divisional Court, decided in favour of the company, and the local authority appealed.

The House affirmed the decision of the Court of Appeal, and the Lord Chancellor dismissed the appeal with costs.

Porte *v.* Veritys, Ltd.

On April 1st, in the King's Bench Division, Dublin, before Mr. Justice Boyd, Mr. Overend applied on behalf of plaintiff for leave to serve a writ out of the jurisdiction. Plaintiff was Mr. A. E. Porte, an electrical engineer, carrying on business in Dublin under the name of Porte & Co. Defendants, who were also electrical

engineers, with their head offices at 31, King Street, Covent Garden, London, and a branch office at William Street, Dublin, were contractors for the electric lighting of the City of Dublin in 1902. Plaintiff tendered for a sub-contract for the erection of electric light standards, and it was accepted, subject to certain conditions which defendants mentioned. That contract was made in Ireland, and plaintiff set out in his affidavit that a sum of £652 15s. 3d. was justly due and owing to him on foot of it, and that part of the debt was admitted. All the witnesses to be examined in the action resided in Dublin, where, it was submitted, the trial could be held most conveniently.

Mr. Justice Boyd granted the motion.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Maintenance of Large Gas Engines.

My attention has been called by several business friends to the letter under the signature of "W. C.," which appeared in the March 12th issue of your valuable paper, and, having under my control one of the largest gas-engine installations, and certainly the largest installation of the Cockerill type, in this country, I shall be glad if you will allow me space to disassociate myself with the letter, the purport of which is entirely contrary to my experience.

The idea that I am responsible for the letter appears to be so general, that I think it is only fair to the gas-engine makers and myself, that I should disclaim responsibility.

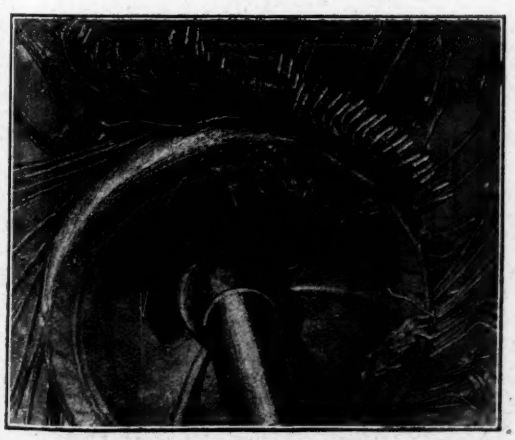
Walter Crooke,
General Manager, Cargo Fleet Steel and Iron Works.

Middlesbrough,
March 30th, 1909.

[This letter arrived too late for inclusion in our last issue.—Eds. E.R.]

How to Catch Rats.

We beg to enclose you a copy of a photograph of a pump motor armature which we think may be interesting to you. The two rats in the upper part of the photograph are shown exactly as they were found; the right-hand one of the two had several corroded marks across its body, where the commutator lugs had been short-circuited through it. The



coil immediately behind the rat in the centre of the picture is short-circuited. The rat at the right-hand bottom corner of the picture fell from the left-hand side when this was in a vertical position, as the commutator was drawn off. It can be distinctly seen that this rat caused a short-circuit, as its body was burnt in a corresponding manner, and close to this short-circuit can be seen in the photograph some fur from the body of the animal.

It will be seen that the armature is ventilated through the core, and no doubt the rats got in through the back end shortly after the armature had stopped running. The armature being warm at this period would, no doubt, be an inviting place for them.

Immediately upon the armature starting to revolve, the centrifugal force would carry them into the positions shown, thus causing the results here described.

per pro **The Sunderland Forge and Engineering Co., Ltd.**
J. Lyon Marr, *Director.*

Sunderland, *March 31st*, 1909.

Sales Engineers.

I have read with interest Mr. Kilburn Scott's article on "Sales Engineers," but cannot agree with him that a representative should have the qualifications of an engineer. An engineer would take some considerable time before he would be able to tackle the commercial side of the electrical business, and fill the position of traveller.

In the first place, he would probably lack tact, and would start putting his own theories down his clients' throats, and this practice has been the cause of many sales engineers leaving the ranks, and going back to the workshops. The up-to-date electrical contractor knows his own requirements, and favours the traveller who faithfully takes down his inquiries and instructions, instead of taking up a lot of his valuable time in trying to teach him his business. A few years in the office of a good electrical contractor will give one sufficient knowledge to solicit inquiries and become a successful traveller, providing, of course, that he has born in him that most essential qualification, "personality."

Many travellers pick up a good sound knowledge of the various apparatus they are running, and know what they are talking about—and it takes a smart engineer to tell whether he is talking to an engineer or a traveller.

Representative.

Cardiff, *April 2nd*, 1909.

I thoroughly disagree with the conclusions arrived at by Mr. E. Kilburn Scott, as expressed in your last issue. Among those who occupy such positions as Mr. E. Kilburn Scott, it seems to be quite the fashion to indulge in such haughty expressions of opinion. For my part, I should say that a principal would appoint his sales manager because of his organising powers and ability to secure business, which, to some extent, would be proved by his past records, which are usually taken into consideration.

Because a sales manager is not always capable of answering some technical conundrum, it does not follow that he is not fitted for his position. Such a position is one that requires experience in many directions, and more often than otherwise the technical man is very poor in this respect.

When Mr. E. Kilburn Scott writes that many sales managers have drifted into their present positions, he is—from my point of view—writing nonsense; this is practically saying that the directors of the electrical profession do not know how to conduct their business. Those with experience know that most positions of this description are competed for—and that there is no prospect of drifting into them. In my opinion, if a man rises from clerk, traveller, or something of the kind, to the position of sales manager, he has something more than a "glibness of tongue and superficial knowledge obtained from catalogues, &c."

With regard to the notice that Mr. E. Kilburn Scott suggests should be given to representatives calling to introduce their specialities—this is quite a new form of tyranny, to compel men to join the Institutions mentioned. What a presumption! From my experience, being a member of such Institutions is no guarantee of efficiency; on the contrary, it is a great mystery to many as to what qualifications are necessary for membership, after meeting some of those who have been honoured by one or the other.

Engineer.

E

Supply by Meter, or Contract?

With reference to H. L. Alderton's letter in your issue of 2nd inst., I regret the inaccurate statement concerning his undertaking. The following is a copy of the paragraph referred to which appeared in one of the leading electrical papers (not the Electrical Review): "The Guildford Electric Supply Co. wire small houses and supply lamps to consumers at 2s. 6d. per lamp per quarter, the current being only available from dusk to daylight." As this statement was not contradicted at the time I naturally assumed that it was correct.

Regarding "Unonot's" letter in the same issue, I endeavour at all times to be very sure of my investigations before making any statements. I carried out *electrical* tests on the electrolytic meters referred to, both at high and low loads, and have never come across the large errors that "Unonot" refers to. For the same reason I do not place too much reliance on stop-watch tests of mercury motor-meters, but prefer a high and low load dial test. "Really good 5-ampere meters may have a straight curve down to ·25 ampere" according to stop-watch tests, but if they are subjected to a six or twelve-hour test at ·25 ampere, the results are not so good. This test cannot be objected to, as it is a practical every-day occurrence on consumers' premises.

As far as I am concerned, this correspondence is now closed.

W. A. Toppin.

April 3rd, 1909.

With reference to Mr. W. A. Toppin's further communication in your issue of the 26th inst., although he states he was not indulging in "generalities," surely he will agree with me that this problem of rotor *v.* electrolytic meters cannot be solved unless the merits and demerits of each type are fully and impartially considered.

The question of the makers of the meters should not enter into the discussion at all; the discussion should be based solely on the qualities of the meters.

As I hold the position of meter superintendent to a large supply corporation, I may assure Mr. Toppin that I have approached this matter in an entirely impartial attitude, fully appreciating the fact that every unit should be registered as far as is possible with the meters at present available.

From the particulars he has furnished, I gather that the two dozen 5-ampere meters he selected were an exceptionally bad batch, and I must congratulate myself on obtaining far better results from my tests of the "most modern mercury rotor meters."

On looking up my records for this type, I find that for those of 5-ampere capacity, the error at $\frac{1}{20}$th load is only 1 to 2 per cent. slower than the error at $\frac{1}{10}$th, the error at the latter load is well within 1 per cent. below the error at full load, and the errors at the intermediate loads of $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ form practically a straight line between $\frac{1}{10}$th and full loads, the tests being conducted with the aid of Kelvin standards. These meters were purchased subject to the requirements quoted in the "British Electric Standards Specification for Meters of October, 1907," and the specified maximum error at $\frac{1}{20}$th load for all sizes was 5 per cent. − or +; if I had obtained the same result as Mr. Toppin on a load of 0·28 ampere of 10 per cent. error slow, I should have applied the simple remedy of rejection.

Mr. Toppin would have been fairer if he had tested a rotor meter of 3 amperes capacity, $\frac{1}{20}$th load of this size being 0·15 ampere. I may add that the error from $\frac{1}{10}$th to full load inclusive should not exceed 2½ per cent. + or − if meters are purchased subject to the aforementioned specification.

He does not state the results of tests taken on the 5-ampere meter before it was fixed on the installation, for which I inquired. This would have been interesting, although not of much value, being an individual case.

With reference to the difficult reading of certain electrolytic meters owing to scum, although he states he has never noticed the same, why has he adopted simple precautions? Surely he would not suggest using distilled water in the work of refilling. I am presuming that he is using both water and mercury electrolytic meters. What, may I ask again, are the results of his tests on electrolytic meters?—as I have noticed a large discrepancy, even with one of these types, unless certain precautions are taken.

J. C. L. V., A.M.I.E.E.

March 31st, 1909.

Polishing Commutators.

Re the advice of "W. P. H.," which coincides with my own practical experience of this method of cleaning "coms," where it has been necessary to polish them through the skin being dirty and uneven, also to meet the critical eye of the "chief," I have used this same formula, and found it very effective on 1,500-kw. machines of 600 volts; it not only does wonders in getting off dirt and grease, but also tends to quieten the chattering and squeaking usual with every carbon-brush machine.

"Conocimiento" asked for advice, not caustic comment, which will not encourage readers to seek advice or ask questions which are interesting to others.

P. W. H.

Margate.

BUSINESS NOTES.

Book Notices.—"*Journal* of the American Society of Mechanical Engineers," Vol. 31, No. 3. March, 1909. Baltimore, U.S.A.: The Society. Price $1.

"Bulletin of the Bureau of Standards," Vol. 5, No. 3. February, 1909. Washington, U.S.A.: Government Printing Office.

"*Proceedings* of the Physical Society of London," Vol. 21, Part 3. March, 1909. London: Taylor & Francis.

"The Cultivation and Preparation of Para Rubber." By W. H. Johnson. London: Crosby Lockwood & Son. 1909. Price 7s. 6d. net.

"Die Normalen Eigenschaften Elektrischer Maschinen." By R. Goldschmidt. Berlin: J. Springer. 1909. Price M. 3.

"*Proceedings* of the American Society of Civil Engineers." Vol. 35, No. 3. March, 1909. New York: The Society.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXVIII, No. 1. January, 1909. New York: The Institute. Price $1.

Birmingham University.—In our list of contracts recently secured by the Phœnix Dynamo Manufacturing Co., Ltd. (see Electrical Review, March 26th, page 510), it should have been stated that the order for the machines for this University was placed with the Phœnix Co. by Messrs. G. A. Steinthal and Boydell, Ltd.

Tantalum Lamps.—In a circular just issued to the trade Messrs. Drake & Gorham, Ltd., announce that after April 13th they will be in a position to supply tantalum lamps for 200-250 volts. Good stocks of 200-230-volt, 1·7-watt lamps, and 200-210 2·2-watt lamps will be held, but there may be slight delay in obtaining supplies of 240 and 250 1·7-watt lamps, and 220 and 230 2·2-watt lamps.

Cuba.—The *Financial News* correspondent at Berlin says that a joint-stock company has been formed at Bremen under the name of the Cuban Electrical Co., with a capital of 4,500,000 marks, with the object of establishing an electrical works and enterprise in the Island of Cuba. Several concessions have already been granted to the new company.

Consular Notes.—Russia.—The German Consul at Kieff reports that electrotechnical goods are chiefly imported from Germany, with the exception of insulation and transmission materials, which are manufactured in Russia in considerable quantities. In the supply of telephone apparatus Germany has to compete with the branches of Swedish works established in Russia as well as with the Polish industry, which produces very cheaply. The Government installations are exclusively fitted with Ericsson apparatus. Electric bells are supplied by the native industry in large quantities, but are rather dearer in price than the German product, which still continues to find a good market. As regards the trade in lighting materials, too, foreign works are finding keen competition on the part of Russian works. The Consul is of opinion that his district promises a good opening for steam turbo-dynamos, in which a considerable interest is now being taken in industrial circles. The majority of the establishments existing in the district are working with antiquated machinery, and it is naturally in their interests to substitute up-to-date and more economical motive power. The greatest preference is given to steam turbo-dynamos of the Parsons type, but German firms have taken up competition with their specialities. The special opportunities for these machines lie in the fact that the foreign firms with works in Russia have not as yet taken up the construction of such machines, and consequently Customs duty and freight enter into the question equally for all parties competing. Dynamos and motors could only live against the high rates of duty in cases of particular types. Germany supplies the greatest quantity of meters and trans-

formers as well as arc and incandescent lamps. The home industry is, however, beginning to take an interest in the production of electric lamps; a firm in Warsaw have already begun the production of arc and incandescent lamps, and another firm in Poland the production of metal-filament lamps. The demand for carbons from abroad has been almost eliminated by the production of the home industry. Parts for lighting installations are being imported in increasing quantities from Germany. The Austrian industry has up to the present found little success in the matter of supplies for the electro-technical trade. The number of electric tramways in the district, which were formerly confined to Kieff, Skitomir and Krementschug, is to be increased by the construction of lines in Winniza (Podolia), and Poltawa. The Kieff tramways are being extended by the construction of new lines. The supply of electric light to the town is in the hands of the Kieff Electrical Co., which works on a concession granted to the Russian Union Co., with German capital. The company also has control of the municipal water-works and partly of the tramways.

The Austro-Hungarian Consul at Moscow reports that the Russian Electro-technical Congress, held in that town in January of the present year, was attended by 600 delegates, and dealt with numerous questions affecting the electro-technical industry. Amongst the more important subjects discussed were the utilisation of Russian water powers for the production of electrical energy, the improvement and extension of the telephone system, the erection of an electrical-technical college and similar intermediate schools, the framing of rules for the prevention of accidents in electrical works, the situation of tramway servants, the formation of an all-Russian electrical combine, &c. In connection with the Congress an electric tramways exhibition was also held.

Chile.—The Cia Carbonifera Los Rios de Curanilahue, province of Arauco, have secured a concession for the utilisation of the water-power of the River Curanilahue for the production of electrical energy for working the Curanilahue-Jani Railway.

Austria.—The Austrian Minister of Railways has authorised the Municipal Council of Mondsee to arrange for the construction of an electric railway from Steindorf, on the Linz-Salzburg section of the State Railways, *vid* Zell and Moos to Mondsee on the Salzkammergut line.

Spain.—A company in Burgos are erecting a large water-power plant in Quintanilla de Escalada to utilise the water-power of the rivers Ebro and Rudron to supply power and light to the town of Burgos, 50 kilometres away. At first three turbines are being installed, which will be coupled direct to generators. Energy at 3,300-volt pressure will be produced, and this will be transformed to 30,000 volts for transmission.

Sicily.—The geological condition of Sicily is very favourable for the erection of hydro-electric power plant. The Societa Elettrica della Sicilia Orientale are at present erecting two such plants, one of 8,000 H.P. at Syracuse, on the Cassibile, with a fall of 275 metres, the other at Taormina, on the Aliantara, of 7,500 H.P., with a fall of 104 metres. The distance for transmission at 40,000 volts, between Messina and Syracuse is about 220 kilometres, and the wires will be carried on steel posts 18 metres high, and 175 metres apart. The distribution system will be 880 km. long for the whole island, and will entail a weight of copper of 790 tons.

Germany.—The export trade of the German electro-technical industry has for some time been on the decline. A slight decrease was first shown in the exports during November, 1908, as compared with the same month in 1907, this decrease became more noticeable in December, 1908, and in the first month of 1909. In January only 3,998,000 kg. of electrical goods were exported, as against 5,448,000 kg. in January, 1908, the decrease thus amounting to 1,450,000 kg., or 27 per cent. In 1908 the exports of the electro-technical industry showed a value of about 185,000,000 marks. All sections of the industry have shared in the decline which has recently been shown, but particularly unsatisfactory has been the trade in dynamos, and Italy especially has shown a far smaller demand for these machines than formerly. The exportation of cables, too, has shown a great diminution. Exports of incandescent electric lamps have increased from 90,900 kg. in January, 1908, to 102,300 kg. in the first month of the present year.

Italy.—The Prefecture of Sondrio have just granted a concession to the Societa Idroelettrica Italiana (a company established in Milan with a capital of 15,000,000 lire), for the utilisation for motive power for the production of electric energy of water from the Masino torrent and from its tributaries Valle dei Bagni, Valle di Mello, Valle Spluga, Valle Sasso Bizolo, Predarossa and Serzana, and for the erection of the hydraulic works necessary for the utilisation of the waters of these streams.

A meeting has recently been held at Frascati under the auspices of the municipal authorities of the district for the purpose of forming a union between the towns of Frascati, Monteporzio and Montecompatri, for the construction of an electric tramway from Frascati to Montecompatri. The project of Ing. Antonino Clementi for a tramway from Rome to Anticoli and Frosinone includes a branch from Frascati to Zagarolo, for establishing communication between Montecompatri and Monteporzio, but the execution of this project, which has been under discussion for some time, has been delayed to such an extent that the Municipalities of Monteporzio and Montecompatri have decided that they cannot remain without communication any longer, and that something must be done immediately to construct this line, which is of such great importance to the towns concerned.

The Communal Council of Marino have decided in favour of the reconstruction of the existing line communicating with Rome. The new line will be worked by electricity and will be of great value to the district as forming a rapid means of transport to Rome. A station is to be erected in the Via Principe Amadeo, at Rome.

Survey works have already been begun on a narrow-gauge electric railway (Alpine system) to unite Feltre and Primolano. This line will be constructed as part of the programme of the Comitato per le Ferrorie delle Alpi Dolomitiche, which has been initiated by plans for the construction of the Agordo-Bribano-Belluno line. The new railway to unite the Belluno lines and the Valsugano railway is of considerable importance, and it is hoped that plans will be ready in the spring.

China.—The German Consul at Canton reports that during 1907 the telegraph lines of the Province of Kuangtung were considerably extended, a new line having been laid from Fatshan to Kongmoon, and thence to Yungkiang. The line is to be further extended to Kachow, whence communication will be established with Pakhoi. The province is in communication with the Island of Hainan by wireless telegraphy—Telefunken system. An electrical works under British control is in operation in Canton, moreover, the Arsenal has its own electrical plant. The chief articles of import are electric meters, electric wires, &c., and these being as a rule imported direct by the electrical company, are usually of British origin. The company hold a monopoly for a number of years, so that it is not anticipated that there will be any change in existing conditions in this respect.

Mexico.—The German Consul at Guadalajara reports that formerly there existed in that town two electrical companies, one French and one Spanish. The latter company has, however, now been purchased by the former, and the two are amalgamated under the title Sociedad Anonima de Tramvias, Luz y Fuerza Motriz. This company has undertaken the working of the electric tramways, and has arranged for communication between Guadalajara and the small town on the Chapala Lake. The company has raised the fares on the electric railway, also the price of electrical energy for lighting and power purposes. In many business localities, and in private houses, lighting is still by alcohol, gasoline and acetylene, and for this reason, as well as on account of the increase in fares on the tramways, the company is working at a loss. In many industrial concerns, too, electric power has been replaced by suction-gas motors, mostly of German origin.

Brazil.—The German Consul at Cuyaba, reporting towards the end of 1908, states that the projected telegraph line from Cuyaba to the Acra district has been taken in hand, and the section between Cuyaba and Serra dos Precios is already completed. The enterprise is of considerable importance to the State of Matto Grosso, not only as forming a means for the rapid transmission of news, but also on account of the reports of the Commission appointed by the Government to execute the works. Not only is the country being explored, but surveys of the whole district covered are to be made. Reports are also made as to the possibilities of the land from an agricultural and cattle breeding point of view, and as to the geological formation of the soil. The new line will thus establish definite information as to the south-western district of Matto Grosso, as yet unknown. It is also proposed to construct a telegraph line from Cuyaba to the River Madeira and to the Amazon.

Switzerland.—Advices from Berne state that the Kander and Hagenek electrical company have applied to the Cantonal authorities of Berne for a concession for the appropriation of water from the Aar and its tributaries. The company have prepared plans from which it appears that they propose to utilise the water available between Innertkirchen and the Grimsel, and that of the following principal tributaries: Trift, Gadmen, Gental and Urbach. For the purpose of utilising this water, it will be necessary to install five plants, which will be arranged so as to give a certain uniformity. The power produced will be destined, in the first place, for electric traction purposes on the railways, and the company wish to be entrusted with the installation of electric traction on the Brünig line. Some of the power will, however, be used for industrial purposes and the establishment of new works, such as those where electro-chemical processes are proposed.

France.—According to La Depeche, of Toulouse, the Société Pyrénéenne d'Energie Electrique propose to erect hydraulic works on Lake Oô for the production of electrical energy. The lake will be transformed into an immense reservoir to collect the waters of the rain and melted snow, and the supply from the reservoirs thus formed will be regulated according to desire. It is anticipated that the execution of this project will have a considerable effect on the industrial condition of the South Western district.

Catalogues and Lists.—"Z" Electric Lamp Manufacturing Co., Ltd., Orient House, New Broad Street, E.C.—List giving particulars and prices of the "Z" metallic-filament lamps, the filaments for which are made entirely in England; also an effective show-card relating to them.

The Swiss Locomotive and Machine Works, 3, Laurence Pountney Hill, E.C. (Mr. E. C. Amos, agent).—Illustrated pamphlet wherein are given particulars of the "Winterthur" gas engines and gas-producers. Engines are made by them up to 2,000 H.P., their designs including single and double-cylinder, tandem, vertical, double-acting types, &c. All engines of from 25 H.P. upwards are fitted with patent valve gear. The gas-producers are for use with anthracite coke and other non-bituminous fuels. A number of views of the Winterthur works appear in the pamphlet.

Messrs. W. A. S. Benson & Co., Ltd., 82/83, New Bond Street, W.—We have received a very artistically-produced pamphlet, entitled "Standard Lamps for Electric Light," from this firm, in which are shown a variety of very acceptable designs for adjustable table and floor and combination standard fittings.

Messrs. Drake & Gorham, Ltd., 66, Victoria Street, S.W.—Pamphlet No. 140, giving some particulars and prices of the "Phœnix" lantern ("Streetlite" patent) specially designed for metal-filament lamps.

Messrs. E. Brook, Ltd., Colne Road, Huddersfield.—Monthly price list (April) of E.B.H. single-phase motors that they are carrying in stock.

Mr. G. Wuthrich, Oswaldestre House, Norfolk Street, W.C.—Two of his standard lists of Oerlikon three-phase enclosed ventilated slip-ring motors with short-circuiting device and brush-lifting gear, No. L32, 30 pp., dealing with motors from 1½ to 12 h.p., 50 cycles, 500 volts; No. L32, 31 pp., relating to those of 14-55 h.p., 50 cycles, 500 volts. These lists may be obtained on application.

Messrs. John Holroyd & Co., Ltd., Perseverance Works, Milnrow, near Rochdale.—Twenty-eight page pamphlet illustrating and describing their forming lathes, those shown including a motor-driven patent railway carriage and wagon axle roughing lathe, and a motor-driven shell nose cap forming lathe.

Bankruptcy Proceedings.—R. Russell (trading as R. Russell & Co.), electrical engineer, Putney.—Last week this debtor again attended the Court House, Wandsworth, for his public examination, but he was only formally questioned, and was allowed to pass.

Bridgewater & Wright, 78, York Road, King's Road, N., electrical engineers.—The first meeting of creditors was held at the London Bankruptcy Court on April 2nd. No statement of affairs was presented, but proofs were sworn by creditors to the amount of £390. The Official Receiver said the case presented a "nice tangle." It appeared that Mr. Wright died in November, 1907, and the business had since been carried on under the same style. Mr. Bridgewater alleged that it was carried on by a female relative, and that there was no partnership between them. He looked after the business, but never paid any money, nor rendered any accounts to the relative in question. On the other hand, she said the business was not hers at all. The goods on the premises had been sold, first, by the landlord for rent, and when he was satisfied, the High Bailiff went in and sold the rest of the goods, and he had now a balance of £26 in hand. The book debts were put at £1,250, but it was not known how far they were good. Of this amount, too, £700 had been assigned as security for money lent. The Official Receiver went on to say it was the most peculiar case he ever had to deal with. On the evidence before him he was not prepared to say that either party could be adjudicated bankrupt. After a good deal of discussion, it was decided to adjourn the meeting until May 3rd, in the meantime the petitioning creditor to consider the position and the advisability of applying for a rescision of the receiving order, and for an administration order.

New Fitting for Factories.—As a result of the demand for an inexpensive but powerful lighting fitting in the various factories supplied by the City of Birmingham Electricity Supply Department, Mr. W. E. Milns, the commercial and consumers' engineer, some little time ago designed a type of cluster light, which has been made up specially for the Supply Department by the General Electric Co., of High Street, Birmingham. So well has the fitting met the needs of factory use, that there has already been an enormous demand for it from consumers in the Midland district. The fitting consists of an enamelled iron shade, under which are two, three, four or six Osram lamps of 100 and 200 c.p., the usual number being four. The particular advantages of such a fitting are that it is suitable for either direct or alternating current, and costs only half as much as an arc lamp, while it has practically the same efficiency as an arc lamp if the efficiency is measured on the effective downward candle-power. The lights may be divided up on two or more switches as required. The fitting is never obsolete, as is an arc lamp, and should the Osram lamps become out of date any later type may be purchased and used in the same fitting. Among other minor advantages may be mentioned the fact that the light is perfectly steady, and the failure of one lamp does not affect the use of the fitting. Practically no attendance is required, and the fitting is suitable for either interior or outdoor use. It is very interesting to note the way in which the lighting problem for factory purposes is being met in the Birmingham district, and incidentally it may be mentioned that it has been found that the low frequency of 25 cycles does not interfere with incandescent lighting so far as factory work is concerned. This, of ourse, cannot be said of arc lighting.

Dissolutions and Liquidations. — Queen's Dock Electric Works, Ltd.—A meeting is to be held at 26, North ohn Street, Liverpool, on May 7th, to hear an account of the winding-up from the liquidator, Mr. S. R. Simmons.

Trade Announcements. — The Mersey Railway Co. has transferred its secretary and accountant's office to Central Station, Birkenhead, and has closed the London office. Consequent upon the death of Mr. G. H. Langham, the secretary and accountant, Mr. J. Shaw has been appointed secretary, and Mr. H. L. Ross, accountant.

The Warner Engineering Co., Ltd., has removed to larger premises at 5, Carteret Street, Westminster, S.W.

The Electric and Ordnance Accessories Co., Ltd., announce that their Stellite Works and offices, Aston, will be closed from p.m. on Thursday, April 8th, to Wednesday, April 14th, at 7.30 a.m.

LIGHTING and POWER NOTES.

Beckenham.—Application is to be made to the L.G.B. for sanction to loans of £2,640 for condensing apparatus and £242 for extension of the economiser. The resident engineer has conferred with the engineer of the South Metropolitan Electric Light and Power Co., Ltd., on the subject of linking up the two undertakings for mutual protection in the case of a breakdown. The clerk, before further steps are taken, is to inquire of the B. of T. whether this linking will be permitted in the present state of the law.

Belfast.—The Abbey Sanatorium Committee has agreed to a scheme of electric supply from the Corporation system. The capital cost of the scheme will be about £4,080, including cable from city boundary, battery, switchboard, motor-generators, &c., as per Mr. Bloxam's estimate, £2,500, and interior wiring, cables, fittings, &c., as per Young & Mackenzie's estimate, £1,580. The supply will be taken off the tramway feeder system, and 2d. per unit will be charged.

Burmah.—In exercise of the powers conferred by Sec. 4 (I) of the Indian Electricity Act, 1903, the Lieutenant-Governor has sanctioned the grant of a licence to the Burmah Electric Tramways and Lighting Co., Ltd., of Mandalay, for the supply of energy within the Mandalay Municipality.

Burslem.—The accounts of the local electric supply undertaking for the year ending December, 1908, show an output of 584,994 units, an increase of 252,112 units sold over 1907; also a net profit of £354. The total costs for the Burslem works are given as '86d. per unit; 22,504 equivalent 8-c.p. lamps were connected, and the maximum load reached 434 kw., this being the third year's working. During 1909 it is expected that two electrically-driven flint-grinding mills will be connected, and will take some 400,000 units per annum, thus materially improving the prospects of the undertaking.

Church.—The Committee appointed to consider the suggested electrical provisional order for Church, reported on March 25th that, after conferring with the Clayton-le-Moors Council, it had waived Clause B, whereby the Council stipulated that the Accrington Corporation should light, at its own expense, every tramway stopping place within Church and Clayton with electric lamps of 60 c.p. capacity. The Corporation refused to concede that on any account, and it meant the whole thing falling through if Church and Clayton insisted on it. Clayton-le-Moors having dropped the clause, Church did likewise.

Colne.—In the minutes of the Electricity Committee at the T.C. meeting on Wednesday, it was stated that an application had been received from Messrs. Henry Brounert & Co., of Manchester, for an electrical supply of some 10,000 h.p. to works proposed to be erected in Colne. It was resolved that the same be referred to the Electricity Committee for consideration and report. It is understood that the application has reference to the establishment of chemical works of a very extensive character, thus introducing a new industry into Colne.

Continental Notes.—Turkey.—Under the aegis of the Schweizerische Kreditanstalt, of Zurich, a trust, with which several of the leading electrical engineering concerns in Germany, France, Switzerland and Belgium will be connected, is, it is reported, in course of formation for the purpose of establishing electric lighting and power plants in Turkey and Eastern Europe generally. As a commencement, the trust will acquire a controlling interest in the Constantinople Tramways Co.

Italy.—A company has recently been formed at Ascoli Picena with a capital of £68,000 and the title La Societe Elettrica del Tronto.

India. — Calcutta. — The Calcutta Electric Supply Corporation, Ltd., delivered to consumers during the four weeks ended February 26th, 1909, 379,751 units, compared with 298,976 units in the corresponding four weeks of 1908.

Madras.—The Madras Electric Supply Corporation, Ltd., have received a cable message from Madras stating that the town supply of electricity has commenced from the company's main generating station, the completion of which has been so long delayed. The supply to the tramways will, it is hoped, be made shortly.

Dudley.—A new feeder is to be laid at Holly Hall at a cost of £2,400. The Electricity Committee has drawn up an amended scale of charges as follows:—Class 1—Long-hour consumers, hotels, clubs, private houses, cafes and hospitals; over 600 units per quarter, 2½d. per unit, under 600 units per quarter, 3d. per unit. Class 2—Theatres, music halls, public halls and free libraries, 3¼d. per unit. Class 3—Churches and chapels, 3½d. per unit. Class 4—Offices, schools and works lighting, 3¼d. per unit. Class 5—Shops, over 1,000 units per quarter, 3d. per unit; over 700 and up to 1,000 units per quarter, 3¼d. per unit; under 700 per quarter, 3½d. per unit. All the foregoing accounts are to be subject to an allowance of 5 per cent., with an additional discount to lighting consumers of 2½ per cent. for payment within one month. The annual growth of the station in the past has been approximately equal to an increase of 100 kw. in the peak load, and although during the present year the output has decreased, the whole of the decrease has taken place in the motor and traction portion of the business, the amount of current sold for private lighting having shown an increase. The decrease in the traction load is due entirely to bad trade, and an increased demand will follow immediately on any revival. After thorough investigation the Electricity Committee has decided (subject to the usual sane-

tion) in favour of the installation of a storage battery of a normal capacity of 300 KW., together with the necessary boosting plant and a motor-generator of 150-KW. capacity for transforming current from lighting to traction voltage, or *vice versâ*. The capital cost of the plant, together with the necessary buildings, is estimated at £6,000.

Eastbourne.—Two 100-KW. transformers with switchgear are to be purchased at a cost of £472. A water softener is to be installed at the power station, but before this is done a report on the water supply and the best method of treating it is to be obtained from the analyst.

Eccles.—The T.C. has instructed the town clerk to report on the powers of the Council to undertake the wiring of private premises for the electric light.

Hanley.—The electrical engineer is to prepare a report as to the advisability of supplying the Milton district with electricity, and as to the probable cost.

Hastings.—At a special meeting of the T.C. on March 30th, it was decided to raise the price of energy to all consumers to 6½d. per unit, and to charge another 1d. per unit for supply to arc lamps; large consumers are to be allowed a discount of 15 per cent. on all energy consumed after the first £100 worth. It is considered that this will produce an extra revenue of £3,678 and meet all deficiencies.

London.—MARYLEBONE.—In connection with the recent proposals of the B.C. to expend some £8,000 in converting the gas lighting of certain streets for electric lighting, a long report has been submitted to the Council.

The question of appealing to the L.G.B., after converting one street experimentally, was discussed, and an amendment that the L.G.B. be referred to in the first instance was defeated by 20 votes to 15. The Committee's recommendation was then carried.

South Africa.—TRANSVAAL.—The *Transvaal Government Gazette* of February 19th contains a notice to the effect that application will be made to the Transvaal Assembly during its next session for leave to introduce a Private Bill authorising the incorporation of a company called the Pretoria Power Co., Ltd., to use the waters of the Crocodile River (Eastern Transvaal) and of its tributaries for the generation of electric power, and to establish wires for the transmission of electric current in the districts of Barberton, Carolina, Lydenburg, Middelburg, Pretoria and Witwatersrand.

The same *Gazette* also contains a notice of intention to apply to the Transvaal Assembly for leave to introduce a Private Bill authorising the incorporation of a company, called the Rand Mines Power Supply Co., Ltd., to establish wires and pipes for the transmission of electric current from a power station to be erected by the company at some point near or between Lawley Station and Canada Junction, along the railway to such points on the same within the Witwatersrand district as the company may desire.—*Board of Trade Journal.*

CAPE TOWN.—The municipality of Green Point and Sea Point (adjoining Cape Town) having invited tenders for street lighting, a sub-committee of the Cape Town City Council has been appointed to deal with the matter and to lodge a tender on behalf of the Council for electric lighting. Green Point and Sea Point are at present lighted by gas, and the basis of the tender by the City Council will be an agreement for 10 years with the sole right to supply electrical energy to private consumers.

Southampton.—At a recent T.C. meeting, Alderman Hollis, in proposing the adoption of the estimates for the general district rate for the ensuing 12 months, and the private improvement rate, stated that the Electricity Committee estimated that its income would be £30,350, but the actual amount was £30,728, a gain of £378, while there was a decrease in expenditure of £417. The amount the Committee estimated to go to the appropriation amount was £2,291, but the success of the department was so great that it carried £3,106 to it. The depreciation and renewals fund now amounted to £8,897, and was in a better state than it had been since the purchase of the works Next year it was proposed to put to the depreciation and renewal account the balance of £1,895, so that on March 31st next year there would be nearly £11,000 in their coffers, which he thought very satisfactory.

Stroud (Glos.).—The B. of T. has asked the U.D.C. if it is prepared to give an undertaking to put the E.L. order into force within a year, in the event of the Board deciding to defer the consideration of the revocation of the order. The Council has replied that, while anxious to carry out its obligations, it could not bind itself to put the order into force within a year.

Thornhill and Witley.—The Yorkshire Electric Power Co. has applied to the B. of T. for permission to erect overhead cables for the supply of energy to Thornhill, Witley and Emley.

Tyldesley.—The U.D.C. has decided to transfer its electrical prov. order to the Lancashire Electric Power Co., but is asking that the amount of the transfer money, £480, be increased to £546.

Walmer.—At a meeting of the U.D.C. on March 31st it was reported that no one could be induced to take over the E.L. order, owing, probably, to the smallness of the area and the difficulty of raising capital. The Chairman said that he was afraid the Council could not take the matter any further. The order was obtained in 1904 at a cost of £200, and the B. of T. recently deferred consideration of its revocation for a month.

West Bromwich.—The Electricity Committee of the Corporation reports that the profit for the year 1907-8 amounted to £2,038, of which £800 was applied in aid of the general district rate, and £241 for payment of the cost of the new building at the stores, High Street, leaving £988 to be allocated. The Committee recommends the establishment of a depreciation and development fund, and that this sum be paid into it.

Wednesbury.—Satisfactory progress is being made with the laying of the electrical mains in connection with the Corporation's electricity undertaking to the King's Hill district, and this, it is expected, will be completed in the course of the present month.

TRAMWAY and RAILWAY NOTES.

Bolton.—The Tramways Committee has received the consent of the B. of T. to the proposed laying of a double line of tramway in lieu of the existing tramway in Bridgman Street.

Farnworth.—It is stated that the South Lancashire Tramways Co. is negotiating with the Bolton Corporation with respect to through running arrangements between Walkden, Clifton and Bolton. The Farnworth U.D.C. is offering no objection to the action proposed to be taken.

U.S.A.—The tube railway authorities operating the line between New York and New Jersey have adopted the system of reserving the last car of each train for women and children, this with a view to avoiding the trouble which has existed owing to the roughness of the crowd during busy hours.

Canada.—A proposal is on foot to construct an electric railway from Ottawa to Meach's Lake, some 25 or 30 miles up the Gateneau Valley from Ottawa.

Edinburgh.—The burgh engineer has reported to the T.C. on the adoption of railless electric traction for the suburban districts of the city. He suggests a route from Tollcross to Juniper Green, some 2¼ miles in the city and 2¾ miles without. The capital cost would be: Overhead equipment, £7,500; 14 cars, £10,500; buildings, £2,000, a total of £20,000. The engineer points out that the use of the roads by a fleet of such vehicles, particularly the macadam roads, will cause serious additions to road repairs.

Liverpool-Southport.—The B. of T.'s report on the collision which occurred near Marsh Lane, on the L. and Y. electrical section, on January 21st, has been issued. Lieut.-Col. Druitt blames the signalman for the collision; Mr. A. P. Trotter, dealing with the fire which occurred as a result of the collision, recommends that fireproof construction should be adopted in the coaches in the vicinity of the motor compartments.

Sandgate.—The U.D.C. has decided to oppose the Folkestone, Sandgate and Hythe Tramways Bill, 1909, and to engage counsel for this purpose.

Continental Notes.—ROUMANIA.—It is announced that the Communal Council of Bucharest accepted the draft Bill relative to the construction of new electric tramway lines, wherein provision is made for the formation of a Roumanian company with a capital of 4,000,000 lei (£160,000), of which the municipality will subscribe a quarter, the balance to be obtained by public subscription. The municipality will also erect, at Grozaveshti, electricity works which will generate power both for electric traction and lighting. For this latter purpose and for other corporation works Parliamentary sanction will be applied for to contract a loan of 10,000,000 lei (£400,000).—*Board of Trade Journal.*

Merthyr Tydfil.—The Merthyr Electric Traction and Lighting Co., Ltd., has applied to the B. of T. for an extension of time until May 16th, 1912, for completing the tramways from Cefn to Cefn Bridge, and for the abandonment of a proposed tramway.

South Shields.—The revenue from the South Shields Corporation tramways during the 12 months ending March 31st last, shows a falling off of £374, as compared with the previous 12 months. The total receipts amounted to £28,717, as compared with £29,092. The number of passengers carried was 7,147,639, as against 7,202,418 during the preceding year, a decrease of 54,779.

Jarrow.—At a special meeting of the T.C. on the 1st inst., Alderman Ramsay, chairman of the Town Improvement Committee, reported that the Committee had considered communications from the Board of Trade and the British Electric Traction Company as to the latter's application for a further extension of time for the completion of the Albert Road section of tramways, and also as to its subsequent application to have its powers cancelled in regard to the section. The Committee recommended that the B. of T. be requested to use its powers to impose as a condition to any extension of time a penalty of at least £500, the amount agreed to by the chairman of the company, or such other condition as will ensure the system being completed in the manner originally designed and authorised by the Order of 1901. The recommendation was agreed to.

Egypt.—The Cairo Electric Railways and Heliopolis Oases Co. has secured a concession for the construction of an electric tramway between Heliopolis and Koubeh, a distance of about two kilometres.

South Lancashire.—With a view to settling the dispute long pending between the Eccles and Salford Corporations and the South Lancashire Tramways Co. as to the running of the latter's cars in the Eccles Corporation's area, an arrangement is now recommended for the Salford cars to run to the Courthouse at Worsley, transfer tickets being provided to enable any person to travel between Winton and Monton and Eccles at the same charge as at present, but by a change of cars.

Accrington.—Having entered into a three years' contract to supply cars and current for the working of the Haslingden tramways, the Corporation is now seeking to obtain running powers from Rawtenstall, to proceed over a mile length of line from Lockgate—the limit of Haslingden boundary—to Rawtenstall terminus; and so restore the through service, &c., that Accrington and Rawtenstall enjoyed in the days of the steam tramways. The charge to Haslingden for cars is 4½d. per car mile, whilst for energy it will be 1·30d. per unit up to 150,000 units a year, and 1·25d. for energy over that quantity.

Congo.—It is proposed to electrify the Matadi-Leopoldville Railway, Belgian Congo.—*African Engineering.*

Rochdale.—The gross revenue of the Rochdale Tramways during the past year has been £53,406, to which has to be added £3,600 taken on the Heywood length. The Rochdale takings show an increase of £544 on those of 1907, and the Heywood receipts are £171 in excess of the previous year.

London.—L.C.C.—The latest report of the Highways Committee deals with the Aldgate to Bow tramways, which it is now proposed to reconstruct partly on the trolley and partly on the conduit system. It will be remembered that the Council installed the "G.B." surface-contact system on this route, and that, owing to unsatisfactory reports as to its operation, the service was discontinued. Subsequently Mr. Mordey, President of the I.E.E., reported by request, and with his approval the owners of the system have since put a mile of route into good order. As a result of the experimental running on this section, Mr. Mordey states that he is satisfied that he has found a remedy for live studs due to arcing. He admits that there may still occur, under certain conditions, a few live studs, which would be detected by the cars in the usual way. Mr. Mordey confidently advises the Council to proceed with the overhauling of the remainder of the route and the equipment of the cars for a full service. The Board of Trade, however, will not commit itself to approval of the line until it has had an opportunity of inspecting the whole route overhauled, and with a full complement of cars for working the same, which would involve considerable further expenditure and time, with possible rejection at the end. The Highways Committee, therefore, considers that it would be better to reconstruct the Gardiner's Corner-Burdett Road section on the conduit system and the Burdett Road-Bow Bridge section on the overhead trolley system, the estimated cost being £66,326.

A large proportion of the expenditure is due to the necessity of raising the road level over the Whitechapel and Bow Railway, and the installing of the overhead trolley system on part of the route is contingent on the Stepney B.C. giving its consent. The chief engineer and chief officer of the tramways consider that the experiments do not satisfactorily remove their former objections to the G.B. system, and have recommended the discontinuance of the system.

The Highways Committee recommends that arrangements be made for obtaining rails and special work for extensions, and that expenditures of £50,000 and £20,000 respectively should be sanctioned on these items.

Owing to the progress made with the Blackfriars Bridge widening, the Committee is recommending certain expenditure in connecting up the tracks on the Embankment and in Blackfriars Road, also in laying track in Southwark Street.

TELEGRAPH and TELEPHONE NOTES.

Hungary.—The telegraph system in 1907 increased from 24,329 km. of line and 130,958 km. of wire to 24,638 km. of line and 136,694 km. of wire—an increase of 309 km. of line and 5,735 km. of wire. The number of offices increased from 3,925 to 4,040. Besides 6,679,893 internal telegrams, 1,781,341 international telegrams were accepted for transmission, and 1,661,763 were received. Transit traffic accounted for 585,239 telegrams, so that the total traffic was 10,708,236 telegrams—an increase over 1906 of 690,784. The telephone system comprised 24,392 km. of line—an increase of 2,289 km. over 1906; and 234,927 km. of wire—an increase of 21,368 km. over the previous year; the number of conversations increased by 16,053,456 to 120,076,566 in 1907. Telegraph receipts amounted to 7,483,298 fr.; telephone receipts to 2,071,429 fr. for conversations, and 5,518,245 fr. from subscribers. The cost of upkeep of both systems amounted to 2,550,641 fr.—*Journal Télégraphique.*

Telegraphic Interruptions:—

Port Arthur-Chifu	March 9, 1904
Pontianak-Saigon	Sept. 16, 1908
Tourane-Amoy...	Jan. 19, 1909

Telephone as Burglar Alarm.—On Wednesday night last week, thieves broke into a store near Ascot and were very busy at their vocation, when one of them accidentally touched the telephone handle. This caused the indicator at the Exchange to drop, and the operator on duty promptly answered the call. As no reply was forthcoming he rang the bell on the stores instrument, and this so alarmed the burglars that they decamped without opening the safe, thinking, perhaps, that there was someone occupying the rooms at the back who would come to answer the operator's repeated ringing, or that some message was being sent to the police. The incident happened at midnight, and it was the first of April before the thieves got clear of the place.

Telephone Transfer.—Mr. B. S. Straus having asked the Postmaster-General whether, in making any working arrangement with the National Telephone Co., Ltd., for carrying on the telephone system, he would insist on all telephone employés being safeguarded, Mr. Buxton replied that he did not anticipate that any such working arrangement would lead to a reduction in the number of telephone employés.

Wireless Telegraphy.—The contract for the 3,000-mile naval wireless station at Washington was awarded on March 10th to the Fessenden Wireless Co. The work is to cost $182,600, including the erection of a 600-ft. tower at Washington and the wireless equipment of several vessels.—*Electrical World*, N.Y.

The Berliner Telefunken Gesellschaft, by using two light portable military instruments, has succeeded in establishing communication between Berlin and Vienna, a distance of 550 km.—the longest distance yet covered with military apparatus.

Commenting on the supreme effort of endurance required of Mr. Binns, the wireless operator on the *Republic*, who telegraphed continuously until the storage battery gave out, in order to guide the rescuing vessels, Engineer Béla Gáti, of Budapest, points out that an ordinary sailor could relieve the operator by sending a simple signal, such as the letter *t*, at uniform intervals. Mr. Duddell has shown that the strength of the current received in wireless telegraphy is inversely proportional to the distance between the stations; hence, if successive measurements of the current are made by means of the Gáti barretter measuring apparatus, a ship hastening to the rescue of the ship in distress could determine both the distance and the direction of the latter from two readings on two different courses, and would thus be enabled to steer directly for the sinking ship and to reach it with the least possible loss of time.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—May 31st. Two 4,700-k.v.a. turbo-alternators, with condensing plant, &c., and one 447-k.v.a. ditto, for the Council's electricity supply department. See "Official Notices" March 12th.

Belfast.—April 24th. Circulating pump and motor for the Laganbank Road pump house of the Tramways and Electricity Committee. See "Official Notices" April 2nd.

Blackpool.—Cables for the Electricity Committee. See "Official Notices" March 26th.

Bradford.—April 28th. Cooling towers for the Corporation. See "Official Notices" to-day.

Cleckheaton.—April 19th. Cables for the electricity department for the year. See "Official Notices" April 2nd.

Dartford.—April 13th. Electric light and telephone installation at Bow Arrow Hospital, for the Joint Hospital Board. J. C. Hayward, Clerk, Sessions House, Dartford.

Dublin.—April 20th. Sub-station switchboards and accessories for the Lighting Committee. See "Official Notices" to-day.

Dundee.—April 9th. The Electricity Department invites tenders for the supply of small coal, general stores, and meters.

Edinburgh.—April 16th. Underground conduits for the electricity supply department. See "Official Notices" April 2nd.

Fareham.—April 22nd. Electric supply mains, transformers and arc lamps and accessories for the Council. See "Official Notices" March 26th.

Halifax.—April 16th. 14,000 tons of pea slack coal for the Tramways and Electricity Committee. W. M. Rogerson, General Manager. Deposit £5.

Leyton.—The electrical engineer is to obtain quotations for service line cables. About £300 worth per annum is used.

London.—Hackney.—April 22nd and May 6th. Arc lamp carbons for one year; also cables, troughing, &c. See two "Official Notices" March 12th.

Hammersmith.—The Electricity Committee proposes to invite tenders for certain new switchgear required for the No. 8 Richardsons-Westgarth turbine and alternator.

L.C.C.—The Highways Committee recommends that tenders be invited for 200 bogie-truck, double-deck electric cars, fitted with roof covers and draught screens.

Stepney.—April 22nd. Pipework, valves, centrifugal pumps, hot-well, &c., for the Electricity Supply Committee. See "Official Notices" April 2nd.

April 23rd.—Installation of telephones and fire-alarms at the South-Western Fever Hospital for the Metropolitan Asylums Board. See "Official Notices" to-day.

Plymouth.—The Electrical Engineer is to be instructed to prepare an estimate of the cost of the installation of electric light at the Grammar School premises in North Road.

Shipley.—April 27th. Electric invalid lift for Sir Titus Salt's Hospital. See "Official Notices" to-day.

Spain.—The Spanish Post and Telegraph authorities in Madrid have just invited tenders for the working of a telephone exchange in the town of Castellon de la Plana.

Sunderland.—April 29th. Cables for the Corporation tramways. See "Official Notices" to-day.

Swansea.—April 23rd. Motors and starting switches, for the Corporation. See "Official Notices" to-day.

Swindon.—April 10th. Materials for the Electricity and Tramway Department. See "Official Notices" March 19th.

Wallasey.—April 19th. Battery, reversible booster, and switchboard for the U.D.C. electricity department. See "Official Notices" to-day.

April 20th.—Stores for the Electricity Department. See "Official Notices" to-day.

Woodbridge.—June 1st. The U.D.C. wants to hear from a company that would establish electric light works in its district, and light the streets electrically. See "Official Notices" March 26th.

CLOSED.

Australia.—Brisbane.—Postmaster-General :—

3,740 yards lead-covered cable, 104 pairs, £274 per mile; 1,760 yards rubber-insulated cable, 18 pairs, £242 per mile; 2,750 yards lead-covered ditto, 152 pairs, £169 per mile.—W. T. Henley's Telegraph Works Co., Ltd.
990 yards lead-covered cable, 78 pairs, at £125; 2,200 yards ditto, 208 pairs, at £622.—Western Electric Co.
7,000 "Acme" insulators, No. 6, 12s. 10d. per 100; 18 tons G.I. wire (400 lb.), £10 14s. 9d. per ton.—Webster & Co.
1,000 Cordeau insulators, 5d. each; 1,000 ditto, small, 2½d. each; 800 terminal insulators, 6½d. each; 3,500 iron spindles (⅝ in.), 3⅞d. each; 500 terminal spindles, 1½d. each; 500 copper joining-sleeves for (100 lb.) wire, 7s. 6d. per 100.—Zwicker, Todd & Co.
500 leading-in insulators and screws, 1s. 9d. each.—Laurence & Hanson.
15,000 "Acme" insulators, No. 1, at £308 18s. 11d.; 16 tons hard-drawn copper wire (200 lb.), £78 11s. 9d. per ton; 2 tons ditto (100 lb.), £78 11s. 6d. per ton; 4 tons sulphur-bronze wire (70 lb.), £87 12s. 6d. per ton.—G. Wills & Co.
10 miles No. 20 V.I.R. copper wire, £6 15s. 9d. per mile; 5 miles No. 18 lead-covered copper wire, £9 16s. 6d. per mile.—Brabant & Co.

Barrow.—The annual contracts for oils, engine-room stores, &c., for the Corporation electricity department include the following :—

W. T. Glover & Co.—Copper wire.
General Electric Co.—Wire, incandescent lamps, casing, &c.
Edison & Swan United Electric Light Co.—Shellac varnish, rubber solution, Para strip and prepared tape.
A. Duckham & Co.—Insulating compound.
H. A. Jackson & Co.—Tumbler switches, lampholders, &c.
John Beard, Ltd.—Arc lamp globes.
Baxendale & Co.—Opal and metal shades.
British Insulated & Helsby Cables, Ltd.—Joint-boxes.
Chamberlain & Hookham, Ltd.—Meters (motor type) and prepayment meters.
Reason Manufacturing Co.—Electrolytic meters and lead seals.
Drake & Gorham, Ltd.—Tantalum and Nernst lamps.
Doulton & Co.—Earthenware pipes and troughs.
J. Nicholls.—Motor boards.

Blackburn.—The T.C. on April 1st appointed the following firms to supply goods to the Electricity and Tramways Committee for the ensuing year :—

Boardman Bros.—Cotton waste.
Booth & Openshaw, Ltd.—Acids, &c.
India-Rubber, Gutta-Percha & Telegraph Works Co.—India-rubber solution, self-adhesive compound tape, &c.
Taylor, Jones & Co.—Firebars.
Spicer Bros., Ltd.—Micanite plate.
Watlington & Co.—Armature insulating varnish.
W. T. Glover & Co.—Diatrine tape.
Siemens Bros. & Co.—Ozokerit non-hygroscopic and P. & B. tapes.
Ruberoid Co.—P. & B. insulating paint.
General Electric Co.—Ebonite sheet and rod.
Hy. Wells Oil Co.—Crank chamber and cylinder oils.
British Insulated & Helsby Cables, Ltd.—House service fuse-boxes.
Veritys, Ltd.—Screwed tubes for inside wiring.

Bolton.—The Tramways Committee has accepted the tender of Messrs. Milnes, Voss & Co. for top covers, also tenders for materials, &c., for the ensuing 12 months.

Bradford.—The T.C. has accepted the tender of Messrs. C. Pratt & Sons, Bradford, for the electric light installation at the Town Hall extension, at £950.

Bridlington.—The T.C. has accepted the tender of Messrs. Ledward & Beckett, Ltd., for condensing plant, at £1,527.

Buxton.—The U.D.C. has accepted the tender of the Bastian Meter Co. for electric meters.

Dudley.—The T.C. has accepted the tenders of the Earl of Dudley for slack, and George Bissell & Son for steam coal, for the electricity undertaking.

Ealing.—The Education Committee has accepted the tender of Park Bros., Ltd., at £487, for the wiring of Lammas Council School.

Edinburgh.—The following is the list of tenders submitted for electric light installation work for the Edinburgh Marine Gardens, Ltd., to specification, &c., by Mr. A. C. Freeman, chief engineer for the directors :—

Pratt Bros., Edinburgh	(accepted)	£478
Colquhoun & Co.		492
Kennedy, Stark & Co.		518
David Stevens		539
Anderson & Munro		552
Lowdon Bros.		557
Bennett & Rutherford		571
John Munro & Co.		594
Stewart & Bucher		595
Walter Scott & Co.		599
James Morton		653
Safety Light, Ltd.		683
Malcolm & Allan		702
Woodward & Co.		738

Leyton.—The D.C. has accepted the following tenders for the supply of six miles of public lighting cables :—

Standard Cable Manufacturing Co.	(accepted)	£563
Aubert Grenier & Co.		630
Union Cable Co.		648
Lahmeyer Electrical Co.		740
Callender's Cable Co.		822
Glover & Co.		822
Henley's Telegraph Works Co.		822
Western Electric Co.		822
Siemens Bros., Ltd.		827
British Insulated & Helsby Co.		828
Johnson & Phillips		838
St. Helens Cable Co.		840

The following tenders have been accepted for annual supplies in connection with the electricity undertaking :—

Wakefield & Co.—Engine oils, £180.
Lucy & Co.—Service terminal boxes, 6s. 6d. mounted (estimated value, £80).
Olive Arc Lamp Co.—Flame arc lamp carbons, £240.
Siemens Bros.—Cable compound, £60.

The Council has placed an order with the Underfeed Stoker Co., at £2,458, for mechanical stokers for eight cylindrical boilers.

The Electrical Co., Ltd., are to supply to the Council Blondel flame arc lamps on trial, provided that they guarantee that the cost of carbons per 4,000 lamp-hours does not exceed £2 19s.

London.—L.C.C.—The Highways Committee received the following tenders from selected firms for mechanically-operated auxiliary track brakes for use on 65 electric cars :—

	Design A.	Design B.	Design C.
Hurst, Nelson and Co., Ltd.	£2,892	£2,762	£2,600
Mountain & Gibson, Ltd., Bury (not to specification)	3,315	3,087	2,535
Electro-Mechanical Brake and Engineering Co., Ltd., West Bromwich	3,412	3,380	3,152
Do., alternative tenders (not to specification)	2,665	2,665	2,405
Brecknell, Munro & Rogers, Ltd.	3,819	3,565	3,477
Heenan & Froude, Ltd.	4,322	4,192	4,015
British Westinghouse Electric and Manufacturing Co.	4,615	4,420	4,290
Do., alternative tender (not to specification)	—	3,575	—

Tenders were invited for three different designs of platform gear as follows—

Design A—With the platform gear arranged for screw operation through machine-cut steel pinions, gears and bevel wheels.

Design B—With the platform gear arranged for screw operation through machine-moulded cast steel pinions, gears and bevel wheels.

Design C—With the platform gear arranged for operation by means of a spindle and twisted chain instead of the screw operation through pinions, gears and bevel wheels as in designs "A" and "B."

The committee consider that the brakes with platform gear made in accordance with design "C" should be obtained. The lowest tender for brakes of this design is the alternative offer of the Electro-Mechanical Brake and Engineering Co., the second lowest offer being that of Mountain & Gibson. Neither of these tenders, however, is in accordance with the specification, and it is accordingly suggested that the next lowest tender, viz., that of Hurst, Nelson & Co., Ltd., amounting to £2,600, should be accepted. The company proposes to sublet certain portions of the work.

Plymouth.—The T.C. has accepted the tender of Walter Scott, Ltd., to supply 120 tons of tram rails and joint and anchor plates at £8 per ton, and fish-plates at £10 per ton. Mr. G. Braulik, whose tender for the annual supply of carbons for the electricity undertaking had been accepted, at £2 17s. 6d. per thousand feet, wrote that the price should have been £3 17s. 6d. The Electricity Committee agreed to alter the price.

Reading.—The Tramways Sub-Committee of the T.C. has accepted the tender of Messrs. Wm. Cory & Sons for 1,800 tons of steam coal for the tramway depôt, at 11s. 2d. per ton.

West Ham.—The Corporation has accepted for the coming year the tender of the Metallic Seamless Tube Co., Ltd., for ordinary and 3-plate ceiling roses.

Wrexham.—The following is a list of tenders accepted by the Electricity Department (Mr. W. G. Pickvance, Borough Electrical Engineer):—

General Electric Co.—Rubber cables.
British Insulated and Helsby Cables, Ltd.—Box compound and service cut-outs.
W. H. Keys, Ltd.—Bitumen.
Reason Manufacturing Co.—Electrolytic meters.
Sloan Electric Co.—Arc lamp carbons.
Jas. Light & Co.—Crank-chamber oil.
Henry Wells Oil Co.—Cylinder oil.
Englebert Oil Co.—Dynamo oil.
Barton & Co. and Wynnstay Collieries, Ltd.—Coal.
Lee, Howl & Co.—Boiler solution.
Veritys, Ltd.—Carbon-filament lamps.

Wimbledon.—The following tenders have been received for the electric lighting of St. Andrew's Church to the specification of Mr. John Hewett, M.I.E.E.:—

Parsons & Townsend	.. ..	£290
Lund Bros. & Co.	.. ..	240
Tredegar & Co.	.. ..	218 16s.
Miskin & Rice	.. ..	(recommended) 205

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERGAVENNY.—Reconstruction of portion of the Monmouthshire Asylum; E. A. Johnson, architect, St. Mary's Chambers, Abergavenny.

BARNSLEY.—Two houses, Blenheim Road; Wade & Turner, architects, 10, Pitt Street, Barnsley. Two houses, Middlesex Street; John Ward, 128, St. George's Road, Barnsley.

BARWELL (near Hinckley).—Probable re-erection, after fire, of boot factory, for Herbert, Farrin & Smith (damage, several thousand pounds).

BECKENHAM.—Seven houses, Blandford Road, for H. C. Wilson; additions to Shortlands Tavern, Station Road, for Nalder & Collyer.

BELFAST.—Enlargement of the premises of the Shankhill Road Mission (£3,300).

BELFORD.—Garage for the A. B. Garage and Cycle Co., Ltd.

BISHOPWEARMOUTH.—New St. Gabriel's Church; C. A. C. Greene, architect, 18, Norfolk Street, Sunderland.

BLACKPOOL.—Warehouse, Lytham Road, for Wm. Holmes; motor garage, Bolton Street, for S. Kent; alterations and additions to premises, Leopold Grove, for T. Hargreaves; alterations and additions to premises, General Street, for Miss Bancroft; alterations and additions to premises, Talbot Road, for J. T. Howell; picture hall, Tyldesley Road and Rigby Road, for W. Morris; houses, Portland Park Estate, for F. Greenwood; Cheltenham Road, for J. Fielding and Sons; Breck Road, for F. Ayre; Warbreck Hill Road, for J. Schmidlin; Bloomfield Road, for J. Taylor; houses, Highbury Avenue, for A. E. Done; Whitegate Drive, for Robert Morgan; Hornby Road, for J. Bailey; Whitegate Drive and Bournville Road, for H. N. Rose; Bank Road, for J. Gregson.

BLAYDON-ON TYNE.—Extension of premises at Crookhill, for the Co-operative Society, Blaydon.

BOLTON.—Proposed new training college, for the Education Committee, for 50 men and 150 women.

BOWBURN (Co. Durham).—Twenty-six houses, for Bell Bros., Ltd.

BRADFORD.—Manse, for the Primitive Methodists (£450).

BRAUNTON.—Residence, &c., for J. Pickard (£925); H. W. Weir, architect, 32, Greenclose Road, Ilfracombe; Slee & Son, builders, Bear Street, Barnstaple.

BRIDLINGTON.—Houses, corner of Midway Avenue and Rhodena Avenue, for T. V. Martindale; Carr Lane, for R. Bailey (J. Earnshaw, architect); Marine Drive, for Mrs. E. Clark (Wellstead, Dosser and Wellstead, architects).

BRIGHOUSE.—New building for Walshaw, Drake & Co., Ltd., worsted dyers, Rosemary Mills, Rastrick.

BRISTOL.—New church of St. John, Fishponds (£8,000); A. R. Ellis, architect, Unity Street, Bristol.

BROMLEY.—Motor garage in West Street; E. J. May.

BURTON-ON-TRENT.—Skating rink, for the British Rinkeries (Midland Section), Ltd.; T. Lowe & Sons, builders, Burton.

CAMBORNE.—Houses (12). Water Stile, for Messrs. Bellman; four in Highville Street, for Mr. Phillips; four in Enys Road, for J. F. Trevillion; Wheal Gerry, for J. Rodda; Brea, for Mr. Bellman.

CAMBRIDGE.—Lecture rooms, at Emmanuel College; warehouse, 44, Fitzroy Street, for H. Whitehead.

CARDIFF.—Proposed institute; H. Darling, secretary of the committee, Dunster Cottage, Sully.

CHARD.—Extension of smith's shop, for Dening & Co.

CHELL (near Burslem).—Dining hall and other additions at the workhouse, for Wolstanton and Burslem B.G.; Ford & Slater, architects, Overhouse Chambers, Burslem.

CHELMSFORD.—Shops, Springfield Road, for A. Bradridge; houses, Market Road, for J. H. Rowe; Maltese Road, for Chancellor & Son; Arbour Lane, for T. J. Bailey.

CHESTER.—Skating rink, for the American Skating Rink Co.; Crawford and Wilkins.

COLCHESTER.—Proposed residence for the Bishop of Colchester (£8,000); Rev. R. Bashford, hon. sec. (*pro tem.*) of the fund.

COWES (I.W.).—Mission Church for St. Mary's Parish; T. Westbrook, builder, Cowes.

DARLINGTON.—Roller skating rink, Stanhope Road; Mr. Pritchett, architect, Darlington.

DARTFORD.—Extensions at Phœnix Works, for Burroughs, Wellcome & Co. Ltd., manufacturing chemists. Houses, Dartford Heath, for J. Hobbs; Hesketh Park H Mitchell; York Road or S. W. Johnson.

DARTFORD.—Repairs at Darenth Asylum; W. T. Hatch, engineer-in-chief to the Metropolitan Asylums Board.

DONCASTER.—Projected music hall in High Street.

DOVER.—Houses, Flints Road, for E. F. W. Lewis, builder.

DUDLEY.—Five houses, New Road, Netherton: J. Watchorn, builder, Cradley Road, Netherton, Dudley. Four houses, Firs Street; H. Pittaway, builder, 96, Humley Road, Dudley. Alterations to New Inn, High Street, Netherton, for North Worcester Brewery Co.

DURHAM.—New Hippodrome, Claypath, for Hippodrome (Durham), Ltd., Middlesbrough.

EASINGTON LANE (Castle Eden, Co. Durham).—Alterations and extensions to premises, for the Easington Lane Co-operative Society; L. G. Ekins, architect, Newcastle-on-Tyne.

ECCLES.—Eleven houses and shop, Thorp Street, Peel Green, for Thos. Eggington; additions to works, Campbell Street, Winton, for H. Cardwell & Sons, Ltd., rope and twine manufacturers.

EDINBURGH.—Eleven villas in Locharton Gardens; J. M'Leod & W. A. M'Leod, care of Neil McLeod & Sons, builders, 81, Harrison Road, Edinburgh.

ELLESMERE PORT (near Birkenhead).—Rebuilding of premises for Parr's Bank, Ltd.

EXETER.—New Wesleyan Sunday Schools; H. Read, architect, 12, Castle Street, Exeter.

FARNWORTH (near Bolton).—Suggested new fire station; W. J. Lomax, surveyor, Fold Street, Bolton.

FEATHERSTONE (Yorks.).—New free library; site given by J. Shaw, Welburn Hall, Kirkbymoorside.

FENTON.—Alterations to the Town Hall; Surveyor to the U.D.C.

FINTONA (Co. Tyrone).—Villa residence for A. R. Steen; T. Elliott, architect, 37, Darling Street, Enniskillen.

FOLESHILL (near Coventry).—New school, Windmill Lane (£6,000); Mr. Lord, builder, Wolston, Coventry.

GLASTONBURY.—Alterations at St. John's schools; H. Alves, architect.

GRAVESEND.—Alterations to business premises, High Street, for T. Stone and Co., ironmongers.

HADDENHAM (Cambs.).—Alterations and additions to Aldreth Road schools, for Isle of Ely C.C.; County Surveyor, Ely.

HANLEY.—New Council Chamber, for the T.C. (£3,500).

HARROW.—Eight houses, Devonshire Road; A. J. Smith. Nine houses, Butler Avenue; R. G. Booth. Three houses, Welldon Park Road; A. Sykes & A. E. Brooker. Four houses, Stanley Road; R. J. Atkins. Two houses, Vaughan Road; J. H. Eyden.

HASTINGS.—Alterations and additions to the Sussex Hotel, Marina, St. Leonards, for the Edinburgh Hotel Co., Ltd.; J. B. Wall, architect, 13, Devonshire Road, Bexhill. Mission hall, Hollington, St. Leonards, for J. Elliott, Hollington; W. T. King, architect, Hastings. Additions to house, 10, Grosvenor Gardens West, St. Leonards, for H. Lee Gros; W. F. J. Pettit, architect. Additions to Greville Lodge, St. Helen's Park Road; Capt. Burtenshaw, Greville Lodge.

HAZEL GROVE (near Stockport).—Rebuilding shop premises for the Co-operative Society; A. Dawson, secretary, London Road, Hazel Grove.

HERNE BAY.—Alterations and additions to Dolphin Hotel (£1,149); Saville and Martin, architects, 5, Arundel Street, Strand, W.C.; L. Seager, builder, London Road, Sittingbourne.

HITCHIN.—Warehouse, Queen Street, for J. Moore. Houses, Hitchin Hill, for Barker & Son, builders, Bancroft; Bearton Road, for A. G. Monk.

HIPPERHOLME (near Halifax).—Villaresidence, Sutherland Road; Walsh and Nicholas, Halifax.

HOLMFIRTH (Yorks.).—Alterations to shop premises, Victoria Street; J. Barraclough & Son, architects, Holmfirth.

HUDDERSFIELD.—Alterations and additions to the Orient Cafe, New Street; Utley, Hebblethwaite & Utley, architects, 10, Waterhouse Street, Halifax. Three houses, Wren Street, Paddock, and workshop, &c., Quarmby Road, Paddock; Lunn & Kaye, architects, Milnebridge.

IRLAM (near Manchester).—Renovation of, or rebuilding, White Lion Inn; Watson & Woodhead, brewers, Salford.

KETTERING.—New Board room, offices and Master's house, for the B.G.; Gotch & Saunders, architects, Bank Chambers, Kettering.

LEDSHAM (Cheshire).—Four houses, for Cheshire C.C.; Land Agent, county estate office, 49, Northgate Street, Chester.

LONDON (Greenwich, S.E.).—Depôt buildings in Norman Road; Borough Surveyor, Town Hall, Greenwich Road, S.E.

(St. Pancras, N.W.).—Operating room at the North Infirmary (£727); Mattock & Parsons, builders, 165, Gray's Inn Road, W.C.

(Chelsea, S.W.).—Alterations to premises, 122 and 124, King's Road, for occupation by Webb, Sons & Clarke, Ltd., provision merchants, Kensington, S.W.

(Kennington (S.E.).—Adaptation of Lambeth Old Town Hall for central offices of the Waifs and Strays Society, Savoy Street, Strand, W.C.

(Lambeth, S.E.).—Seventeen houses, Aquinas Street; J. Parsons, builder, 190, Waterloo Road, S.E.

(Wandsworth, S.W.).—Iron buildings, Swaffield Road, for the Guardians (£4,106); E. Wall, builder, Alice Works, Somers Town, S.W.

LONDONDERRY.—Additions to Hinton House, for R. A. Wilson; R. A. Buchanan & Co., architects, Castle Street, Londonderry. New police office and morgue, at Victoria Market; P. H. Elliott, architect, Castle Street, Londonderry.

LONGWOOD (Yorks.).—Additions to Prospect Mills; J. Berry, architect, 8, Market Place, Huddersfield.

MAIDSTONE.—Residence (£2,476); St. P. Harris, architect, 8, Laurence Pountney Hill, E.C.; W. Archer & Son, builders, The Grove, Gravesend. Premises, High Street, for the London and County Banking Co., Ltd., London. Bottling room, East Street, for Fremlin Bros., brewers.

MANCHESTER.—Proposed free library, art gallery and lecture hall on the old infirmary site.

NARBERTH.—New Masonic hall; J. P. James, architect, Tenby.

NEW BRIGHTON.—New Presbyterian Church; Rev. T. W. Armstrong.

NEW BROUGHTON (Denbighshire).—School for the C.C.; W. D. Wiles, county architect.

NEWTOWN.—Refuse destructor, for the U.D.C. (£600).

NORTHAMPTON.—Motor spirit store, L. & N.W. Railway Goods Yard, Bridge Street, for the Bowring Petroleum Co, Ltd., 5, Billiter Avenue, E.C.; additions to factory, Simpson Avenue, for J. Sears & Co.; additions to Liberal Club premises, St. Giles' Street; two houses, The Broadway, R. Cleaver, builder, 12 and 14, Wood Street, Northampton. Alterations to King's Head public house, Mayorhold, for P. Phipps & Co., Ltd.; class rooms and vestry, Kingsthorpe Baptist Chapel, High Street; skating rink, St. James' Park Road, for Byng-Hall, Goodricke & Percy; additions to factory, Kettering Road, for J. E. Taylor; skating rink, H. H. Dyer and Sons, architects, Northampton.

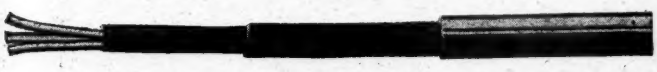
NOTTINGHAM.—Proposed home and other premises, Carlton Road, for the Dakeyne Street Lads' Club; Oliver W. Hind.

ORPINGTON.—Pair of shops (£1,000); St. P. Harris, architect, 8, Laurence Pountney Hill, E.C.

PAWLETT.—Additions to Council School (£280); C. H. Bothamley, Weston-super-Mare.
PENDLETON.—Blocks of 260 houses; E. Talbot & Sons, 54, Deansgate, Manchester.
PITTINGTON (Co. Durham).—Proposed parish hall and institute.
PLYMOUTH.—Alterations at North Road School; Hine, Odgers & May, architects, 23, Lockyer Street, Plymouth.
PONTLOTTYN (near Cardiff).—New higher elementary school; D. Pugh-Jones, county architect.
PORTSMOUTH.—Houses, Cousins Grove, W. Ward, Coburg Street, Portsmouth; Funtingdon Road, R. J. Winnicott; Tranmere Road, E. White, "Omega," Eastney Road, Portsmouth.
ROYTON (near Oldham).—Proposed Central Hospital (£50,000); Surveyor, Council offices, Royton.
READING.—Residence in Warwick Road; Webb & Sutton, architects, Market Place, Reading. Proposed alterations, &c., at Wesley Church, Queen's Road; Rev. J. W. Clegg, 84, Queen's Road.
RETFORD.—Mission room for St. Saviour's parish; the vicar.
RHYL.—New buildings on the pier, for the Pier Co.; Maxwell & Tuke, architects.
ROCHESTER.—Block of offices (£8,900); L. Seager, builder, London Road, Sittingbourne.
RUABON.—Proposed Council school; Denbighshire Education Committee.
RYDE (I.W.).—Proposed extension for water scheme, for the T.C. (£12,000).
ST. HELENS.—Six houses, Derbyshire Hill Road, for J. Sharples.
SELBY.—Proposed new works for J. Watson & Sons, Ltd., soap manufacturers, Leeds.
SEVEN SISTERS (near Neath).—Proposed manse; J. C. Rees, architect, Parade Chambers, Neath.
SHEFFIELD.—Extension of the Royal Hospital (£90,000); G. Longden & Sons, builders, Neepsend, Sheffield. New Wesleyan Chapel at Darnall.
SHIPLEY (Baildon).—Two residences; J. Barton & Son, architects, Halifax Road, Dewsbury.
SHREWSBURY.—Probable re-erection (after fire) of premises, Pride Hill, for J. & B. Blower, house furnishers (damages, £2,000).
SOUTH SHIELDS.—Shop extension at corner of Frederick Street and Bertram Street for Mrs. Biles; J. H. Morton, architect, King Street, South Shields. Meeting rooms at 3, 5 and 7, Geo. Potts Street, for Plymouth Brethren; J. W. Wardle, architect, Fowler Street, South Shields.
WEMBLEY.—Four houses, Eagle Road, G. Poole. New Methodist Church, Ealing Road, H. Haynes.
WEST AUCKLAND.—Church Hall; F. H. Livesay, architect, Newgate Street Bishop Auckland.
WIGAN.—Houses (14), Throstle Nest Avenue, for Mrs. Eckersley; two in Barnsley Street, for M. Clayton.
WILMINGTON (near Hull).—Goods offices, for the North-Eastern Railway Co. W. Bell, architect to the company, York.
WITHAM (Essex).—Motor works for J. Smith & Son.
WOLVERHAMPTON.—Alterations, &c., to offices, Stafford Street, for the B.G. (£672).
WORKSOP.—Chapel at the College; Sir A. Webb, 19, Queen Anne's Gate, S.W., and B. Ingelow, Carlton Chambers, 4, Regent Street, S.W., joint architects.
YORK.—Roller skating rink, for A. E. Wynn, Harrogate; J. Houle, architect, Station Chambers, Harrogate.

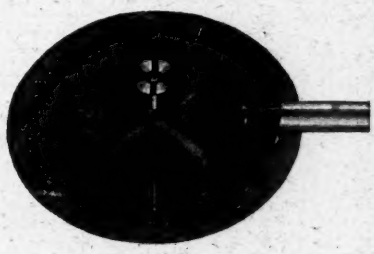
THE O.S. WIRING SYSTEM.

On Friday last we inspected, at Messrs. Siemens Brothers & Co.'s new offices in Caxton House, a new system of wiring which is being introduced by the firm—new, that is, as regards the details of the



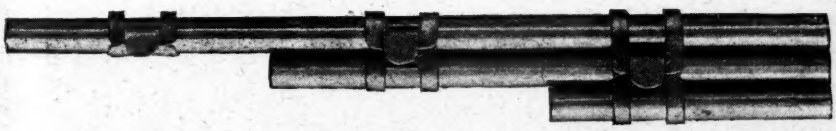
3/20 Kuhlos Wire.

Single-wire Buckle Clip.

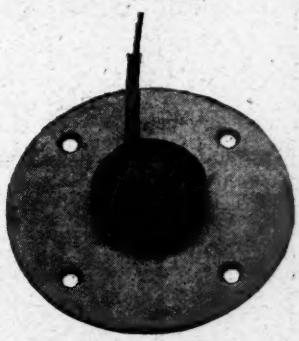


Side-Entry Continuity Fixture showing Stannos Wires under Spring Plate.

3/20 Stannos Wire.



Method of Fixing Metacase Wires with Buckle Clips.



Back-Entry Continuity Fixture showing Wire under Clamp.

SPENNYMOOR (Co. Durham).—Shops, offices, &c., for J. A. Dees; alterations and additions to the Church of England Schools.
STEVENAGE.—House and bakery, Providence Road, for F. Gray.
STOCKPORT.—Infants' school at North Reddish; Cheers & Smith, architects, 24, Richmond Terrace, Blackburn.
STOCKTON-ON-TEES.—Alterations and additions to the County Police Station; W. Crozier, County architect, Shire Hall, Durham.
STOKESLEY.—Alterations and additions to the police station; W. H. Brierley, architect, 18, Lendal, York.
STREET FOLD (Lancs.).—New United Methodist Chapel (£2,000).
SUTTON-ON-SEA.—Wesleyan Church and school rooms; J. Wills & Sons, architects, Victoria Chambers, Derby.
SWANSEA.—Ten houses in Llangyfelach Road; S. & F. Weaver, builders, Manselton. New Baptist Chapel, Cecil Street, Manselton. Rebuilding 25, Waterloo Street, for Messrs. Pugsley. Additions to Café Monico, High Street, for A. E. Richards, High Street; seven houses, Bernard Street, for S. L. Lewis; four houses, Ernald Street, for W. Rice; 43 houses, Coedsaeson, for Rd. Hodgens.
TAUNTON.—Additions St. Mary's Boys' School (£3,000); Archdeacon Askwith. Additions to Parade Assembly Rooms; F. W. Roberts, architect, Hammet Street, Taunton.
THORNTON-IN-THE-MOORS (near Chester).—Renovation of Parish Church, after fire.
TROWBRIDGE (Wilts.).—Villas, Wingfield Road, for E. Linzey, builder, Dorset House, The Halve.
UPMINSTER (Essex).—New Congregational Church in Branfill Park.
WALKDEN.—Infants' school, for Whittlebrook Wesleyan Sunday School; S. Rawlinson & Son, contractors, Swinton, near Manchester. Blocks of houses, Old Clough Lane; Harrop & Hughes, contractors, Kay Street, Walkden.
WALLINGFORD.—Five houses (£1,100); E. G. Hearness, architect, Wallingford.
WARRINGTON.—Alterations to St. George's Home, Salisbury Street, for the Trustees of the Waifs and Strays Society.
WATFORD.—Place of worship, Leavesden Road (£4,150); G. Baines & Son, architects, 5, Clement's Inn, London; Brightman & Son, builders, Watford.
WATH (Yorks.)—Extension of the administrative department of the Hospital (£350)
WELLINGTON.—Additions to Courtland Road school (£232); W. J. Willcox, surveyor, Bath.

material used. This system is put forward in conjunction with the "Kalkos" system patented by Messrs. Handcock & Dykes (already described in our pages), for the sale of which Messrs. Siemens Brothers have taken up a licence. In the Kalkos system, it will be remembered, tinned brass conduits and fittings are employed, with soldered joints throughout.

The "Kuhlos" system consists of semi-flexible wires cased throughout with plain or tinned brass or copper, and is intended for use in conjunction with patent continuity fixtures and wood blocks for surface wiring only; the brass cover is put on with a rolled longitudinal bead, as shown in the accompanying figure.

"Stannos" wires consist of rubber-insulated wires covered with a tinned copper sheath, lapping twice round the wire and having a longitudinal soldered seam, which is almost invisible. It is in the special method of applying and securing this sheath that the chief novelty is found. Stannos wire is very small in diameter (see figure), extremely neat, waterproof, and suitable for surface wiring with wood blocks and ordinary accessories; surface wiring with Kalkos surface boxes, and concealed wiring with Kalkos sunk boxes. A groove ½-in. deep and wide amply suffices to receive any practical size of Stannos wire—the largest listed is 7/20, measuring overall ·264 in., while 3/20 single-taped as illustrated is only ·196 in. in diameter.

Obviously watertightness and electrical continuity of the sheath are strong points in favour of this material, which also is readily erected and works in conveniently with the Kalkos and Kuhlos systems, the three forming together the O.S. wiring system.

We illustrate a set of three "Metacase" conductors, as these are also called, secured with simple buckle clips, of one of which a separate view is given. We illustrate also two of the continuity fittings, showing how they are used to clip the outer sheaths of the conductors. While conductors cased in metal are, of course, by no means new, the special advantages of these systems certainly appeal to one as likely to ensure for them a considerable demand. It is contended that wiring can be effected with "Metacase" wires

at a remarkably low cost, and in illustration of this Messrs. Siemens have fitted up in a special showroom a variety of circuits and fittings, showing the simplicity and handiness of the system.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Wednesday, April 14th. At 8 p.m. At St. Bride's Institute, E.C. Paper on "Stresses and Strains in Girder Work," by Mr. H. Adams.

Junior Institution of Engineers.—Saturday, April 17th.—At 3 p.m. Visit to the Chingford Reservoir Works of the Metropolitan Water Board.

NOTES.

The Government and Exhibitions.—A fortnight ago we briefly mentioned the appointment of Royal Commissioners for three forthcoming exhibitions. From official information received from the Board of Trade, we learn that in connection with the exhibition at Brussels in 1910 there will be inaugurated a new policy on the part of His Majesty's Government with regard to official participation in foreign international exhibitions. It has been felt for some time past that British exhibitors have been at a disadvantage as compared with those of other countries, owing to the absence of any permanent organisation for preparing the British section at important international exhibitions. A committee was consequently appointed by the President of the Board of Trade in 1906 to make inquiries and report as to the nature and extent of the benefit accruing to British arts, industries, and trade, from the participation of this country in great international exhibitions, and to advise as to the steps which should be taken to secure the maximum advantage from any public money which might be expended on this object.

As a result of the recommendations contained in the Committee's report, a special branch of the Commercial, Labour and Statistical Department of the Board of Trade was recently established to deal with all matters relating to the participation of Great Britain in foreign international exhibitions, and active preparations are now being made for the organisation of a comprehensive display of British arts and manufactures at the three exhibitions in question. Arrangements have already been concluded with the exhibition authorities at Brussels, Rome and Turin, by which an advantageous site has been secured for the British section at each of these exhibitions. The Lords Commissioners of the Treasury have expressed their willingness to ask the sanction of Parliament to a grant in aid of the cost of organising the exhibits, and the principal railway and steamship companies have notified their willingness to assist in promoting the success of the British sections by according substantial reductions of their usual rates of freight for the return of unsold exhibits at the close of the respective exhibitions.

From reports which have been received through the Foreign Office from His Majesty's Consular officers in Belgium and Italy, it is thought that the exhibitions at Brussels and Turin will afford a valuable opportunity of promoting and extending British trade with those countries. In view of the important scale on which other nations are preparing to anticipate, it is hoped that every effort will be made by manufacturers in the United Kingdom to furnish a display of exhibits which will worthily maintain the reputation of Great Britain as a manufacturing country.

The Brussels Exhibition, which will include sections devoted to art, science, industry and agriculture, is to open in April, 1910, and will continue for a period of about six months. The grounds, which cover an area of approximately 200 acres, are situated in the new quarter of the Avenue Louise, adjoining the Bois de la Cambre, at a distance of about three miles from the Gare du Midi, and about 3¾ miles from the Gare du Nord. The space allotted to Great Britain amounts in all to 203,140 sq. ft., of which 150,640 sq. ft. are situated in an imposing building immediately adjoining the main entrance to the exhibition, and the remainder in a central position in the International Machinery Hall.

The exhibitions at Rome and Turin will open in April, 1911, and continue for a period of about six months. They are being held to commemorate the 50th anniversary of the proclamation of the kingdom of Italy, and are under the patronage of H.M. the King of Italy, and the honorary presidency of H.R.H. the Duke of Aosta. The exhibition at Turin will be devoted to industry and labour, and that at Rome to Art and Archæology. The site chosen for the Turin Exhibition is in the Valentino Park, and covers an area of about 247 acres. A site has been secured for the British section containing 263,718 sq. ft. in a commanding position on the left bank of the River Po, at an elevation of some 30 ft. above the level of the river. In addition to the main building an option has been secured on a further area of some 123,786 sq. ft., which will afford sites for the pavilions of any of the self-governing Dominions or Crown Colonies which may decide to participate.

The first meeting of the Royal Commission, at which H.R.H. the Prince of Wales presided, was held at Marlborough House on Monday.

A list of manufacturers, comprising the names of over 20,000 of the leading firms in the different branches of industry likely to be represented at the exhibitions, has already been prepared in the exhibitions branch of the Board of Trade, and invitations to exhibit will in the first instance be sent direct to these firms. Supplementary lists of firms to whom invitations should be sent are also to be prepared with the advice of the commercial representatives on the Commission, and full information will be supplied to intending exhibitors upon application to the Director of the Exhibitions Branch of the Board of Trade, Queen Anne's Chambers, Broadway, Westminster, S.W.

A Gas-Electric Railway Car.—In connection with the application of electricity to railway work, it is interesting to note the recent construction by the General Electric Co., of Schenectady, N.Y., of a gas-electric car for railway service, the main object of the design being to secure maximum carrying capacity and minimum weight in a car of great strength. The car is single-ended, the shape of the ends being parabolic, thus reducing the air resistance to a minimum when travelling at high speed. The length overall is 50 ft., the total weight 31 tons, and the seating capacity 44 persons. The gasolene engine is direct-coupled to a 90-KW. D C. generator, furnishing current at a varying pressure—the current being fed to the motors through a control system, by means of which the voltage of the generator may be governed according to requirements. The two motors are of G.E. 72A type, each rated at 60 H.P. The engine was designed and built by the General Electric Co., special attention being paid to its simplification. The weight of the engine, generator, air compressor and bed-plate is only 7,600 lb. When running at 550 R.P.M. the engine develops 100 H.P. It has eight cylinders, of 8-in. dia. and 7-in. stroke, placed at 90° to each other, this arrangement giving a very satisfactory system for balancing purposes.

The difficulty in starting gasolene engines of this size has been overcome by the provision of special breech block mechanism, which fires a charge of black powder into one of the cylinders.

The generator is a General Electric 90-KW. 8-pole separately-excited machine, especially designed to procure the lightest possible machine for the output with reasonable temperature rise. It has commutating poles—these, together with the pressure type of control, giving great flexibility of current output. The total weight of the generator, including exciter, is 2,740 lb., while a standard machine of this output weighs 8,800 lb. The efficiency of the generator is 88 per cent. The exciter is a 3-KW. 70-volt shunt wound machine, with its armature mounted directly on the shaft of the main generator, and its field yoke supported by the bearing brackets.

A storage battery floating on the exciter circuit is used for supplying the lighting circuits, a Tirrill regulator being used to control this voltage. The master controller, which has some unique features, gives seven steps with the two motors in series, and eight steps with the two motors in parallel. It is provided with four handles, three of which are mounted one above the other on concentric shafts: the top handle advances or retards the ignition, the second controls the throttle of the engine, while the third controls the generator field resistance and the contactors; the fourth handle operates the reversing switch.

The car is heated by passing the exhaust gases through pipes suitably located in the car body; it is also provided with a straight air-brake equipment, and the air is supplied by means of a compressor directly coupled to the engine.

The approximate maximum speed of the gasolene electric car on the level is from 50 to 60 miles per hour, including stops at infrequent intervals.

The Victoria Falls and Transvaal Power Co.—The prospectus of this company, to which we allude in our "City Notes" to-day, has drawn the following criticism from Mr. Theodore Rich, whose letter appeared in the *Times* of Monday last:—"It is interesting to note from the detailed prospectus of the Victoria Falls and Transvaal Power Co. recently issued that contracts for the supply of the whole of the electrical machinery required have been placed in Germany.

"Counting the orders placed and those that will eventually be placed to supply the mines with electrical plant, the value of work lost to the manufacturers of Great Britain will exceed 3 millions sterling. Judging by recent public contracts at home and abroad, British steam electric turbine machinery is cheaper and more reliable than that made in any other country, and it is significant that the prices to be paid for this German machinery are not specifically stated in the complete prospectus.

"The development of the steam turbine as a heavy power unit has been due to British enterprise and the genius of the Hon. C. A. Parsons, and a country that can build a 70,000-H.P. *Mauretania* can certainly build a 30,000-H.P. generating station. The results that have been obtained with the machinery in the power stations of the London County Council tramways and the Glasgow Corporation lighting departments have been unequalled on the Continent, taking into account the working conditions, and this shows that it is quite unnecessary to call in Continental engineering experts to assist in power generation or transmission work of this character.

"It seems a pity that a British company should assist in creating a virtual monopoly for German electrical manufacturers on the Rand, at a time when a number of large engineering works are on short time and thousands of unemployed are to be found in our large cities, and the British taxpayer is being called upon to make heavy sacrifices to pay for the Transvaal debt and the cost of new Dreadnoughts to compete with German naval aspirations.

"It is very usual to hear financiers and other business men running down the manufacturers in this country, though statements

of this kind are not always of a disinterested character; and with regard to electric power machinery, given financial support, open contracts, and fair play, British manufacturers have nothing to fear with reference to price or quality from any foreign country. —Theodore Rich."

Territorial Employment Register.—The Territorial Force Association of the County of London inform us that they have on their Employment Register, which they keep for men enlisted in the County of London Regiments, a number of applications for employment. A military recommendation stands a man in good stead, in addition to the testimonials of his previous employment; the fact that a Territorialist is nowadays a keen and disciplined man can only add to his value in business, where discipline governs success in these times of trade competition. The London County Association point out the reasons why every effort should be made to give assistance to Territorialists. It is hardly necessary to say that a man enlisted in the Territorial Force is performing a duty to the State, and that his fellow citizens can perform a duty on their part by giving him work when there are vacancies to fill, or extra labour is required. If employers will write or telephone to the Secretary, Territorial Force Association of the County of London (1,451 City), Craig's Court House, Charing Cross, S.W., stating their requirements, copies of applications will be sent them, and the Association will at once communicate with those whom the employer desires to consider. A couple of days' notice should, where possible, be given, as men do not always go to their headquarters other than on drill nights.

Appointment Vacant.—The Plymouth Education Committee has decided that it can no longer rely on a part-time teacher at the technical school for the teaching of electrical engineering. A mechanical engineer who has specialised in electrical engineering is therefore to be appointed from September next, at a salary of £200 per annum.

Football.—On Thursday last week a match was played at Wandsworth between the L.C.C. Football Club and the Wandsworth Thursday. The result was as follows:—Wandsworth Thursday, 4; L.C.C. F.C., 2.

Ship Lighting.—A paper on "Electrical Installations on Steamships," was read by Mr. H. T. Boothroyd at the eleventh meeting of the present session of the Liverpool Engineering Society on Wednesday, March 31st.

National Electrical Manufacturers' Association.—The annual general meeting of this Association was held at Dartmouth House, Westminster, on March 23rd, Mr. H. Bevis presiding. The report of the Committee pointed out that the Manchester Electrical Exhibition, which had been initiated by the Association in conjunction with the Manchester Corporation, had proved a great success. Members of this Association who had exhibited, had received a preferential discount on rent for space which had averaged more than their yearly subscription to the Association, in addition to the further return which had been made to all the exhibitors. A meeting of manufacturers of electric light fittings had been recently held with a view to deciding on a uniform procedure in certain cases. In order to increase the usefulness of the Status Bureau, the Committee proposed that this should be worked in conjunction with the British Traders' Association. A satisfactory scheme had been drawn up giving considerable benefits to members. The services of the Association had been of use to a member in a dispute with a railway company. Mr. Bevis had been elected chairman of the Committee. The secretary, Mr. Davenport, having resigned, Mr. F. B. O. Hawes had been appointed to succeed him. The offices of the Association will be moved to Balfour House, Finsbury Pavement, on March 25th. In moving the adoption of the report, the chairman drew attention to the benefits which the members had, in the majority of cases, obtained from the Association, and several members present, in supporting him, stated that they had saved their subscriptions many times over owing to the assistance obtained from the Association. The chairman also pointed out that the meeting of manufacturers of electric light fittings had been well supported, and they had resolved to hold a further meeting. The report and accounts having been duly adopted, the retiring members of the Committee were re-elected, and Messrs. B. Longbottom and D. N. Dunlop were elected members of the Committee. Messrs. Stanley Marsh and Beaver were elected auditors, and the election of Mr. F. B. O. Hawes as secretary was confirmed, as also were the arrangements with the British Traders' Association.

Panama Electric Power.—Six Curtis 1,500-kw. turbo-generators have arrived at the Isthmus of Panama for installation at Gatun and Miraflores, where power houses are now under construction for the permanent electric power generating plants, which will supply electrical energy for the work of construction of the locks at Gatun, Pedro Miguel and Miraflores. Foundations are being rapidly constructed for the machinery received, and the power houses will be entirely completed within a few months. All operations in building the locks will be conducted by electric power, from the time the raw material is received in scows coming up the old French canal until the concrete is in the forms at the locks. The power plant will be laid out, and the feeders so arranged, that the consumption of kw.-hours of each operation can be ascertained. The Gatun plant will be ready first for operation. After the locks are built the steam power plants will be held in reserve to operate the locks at times when the proposed hydro-electric plants may be short of water.—*Electrical World*, N.Y.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—In our reference to the Southwark engineership last week, instead of stating that Mr. F. T. Wright had been given temporary charge of the station, pending the filling of the vacancy, we should have said that "it is proposed." In the Council agenda the E.L. Committee reported recommending the granting of a testimonial to Mr. Kinghorn for the excellent work performed by him during his five years of office, and they added a paragraph containing a proposal on the lines indicated above; when the Council met, the testimonial recommendation was carried, but the paragraph mentioned was withdrawn, and it was agreed that Mr. D. M. Kinghorn continue in the service of the Council until the new appointment was made.

The Dover T.C. has increased the salary of Mr. H. Brown, shift engineer, from £90 to £100 per annum.

Tramway Officials.—Out of nearly 110 applications for the post of tramways general manager to the Bournemouth Corporation, the short leet was eventually reduced to the following:—Mr. F. Ayton, tramways manager and borough electrical engineer, Ipswich Corporation; Mr. C. Barber, tramways manager and engineer, Bournemouth; Mr. C. W. Hill, chief assistant and electrical engineer, Birmingham Corporation Tramways; and Mr. P. J. Pringle, tramways manager and borough electrical engineer, Burton-on-Trent Corporation. These gentlemen appeared before the Tramways Committee on Tuesday, March 30th, the voting eventually being 7 for Mr. Hill and 6 for Mr. Barber. The result was to come before the Council on Tuesday, April 6th, for confirmation.

Mr. F. W. Ketley, manager of the Douglas (I. of M.) Southern Electric Tramways, has been appointed to succeed Mr. Alan Banister (who has resigned after 11 years' service) as engineer and manager of the Norwich Electric Tramways Co.

General.—Mr. J. Stottner, M.I.E.E., resigned his position in the Electrical Co., Ltd., in August, 1908, and severed his connection with the company in a quite amicable spirit on March 31st. During the 15 years of his management, the Electrical Co. made great progress, particularly in large industrial installations. Mr. Stottner is commencing operations on his own account, and particulars of his movements will be announced later. His private address is Weston House, Hendon, N.W.

Prof. Henry Adams, M.Inst.C.E., &c., of 60, Queen Victoria Street, London, E.C., has taken his eldest son, Mr. Henry Charles Adams, A.M.I.C.E., A.M.I.M.E., A.M.I.E.E., &c., into partnership with him in his practice as a consulting, civil and mechanical engineer, under the style of Henry Adams & Son, at the above address; their Birmingham office is at 1, Waterloo Street.

Mr. William Barclay Parsons, chief consulting engineer of the Interborough Rapid Transit Co., has been elected a director of the Underground Electric Railways Co. of London, Ltd. Col. Millard Hunsiker, late representative in England of the United States Steel Co., and Mr. W. C. Burton, of the firm of J. G. White & Co., Ltd., have also been elected directors of the Underground Co.

Mr. Frank Hewer has resigned the position which he has held on the staff of Messrs. J. G. White & Co., Ltd., for the past seven years, in order to take up the post of sales agent for the United States Steel Products Export Association, in succession to Mr. Gallagher.

Mr. S. B. Cottrell, M.Inst.C.E., M.I.Mech.E., whose retirement, through illness, from the chief engineership of the Liverpool Overhead Railway, took effect recently, has taken offices in Century Buildings, North John Street, Liverpool, where he practises as a general consulting engineer.

Mr. W. W. Vyle, on his retirement from the position of superintending engineer of the Post Office Telegraphs, South Wales district, has been presented with a roll-top desk and a barometer, also a gold brooch for Mrs. Vyle. There was an attendance of about 350 at the presentation, which took place last Saturday week. Mr. Vyle is succeeded by Mr. R. McIlroy, from the engineer-in-chief's office, London.

NEW COMPANIES REGISTERED.

Wireless Syndicate, Ltd. (102,150).—This company was registered on March 23rd, with a capital of £4,000 in £1 shares, to adopt an agreement with R. C. Gallotti, and to carry on a business not particularly described except in the title. The subscribers (with one share each) are:—M. Quay, 69, Corinne Road, Tufnell Park, N., secretary; H. Chesterman, 116, Fortune Green Road, West Hampstead, N.W., clerk. Private company. The number of directors is not to be less than two or more than three; the first are not named; qualification, 10 shares; remuneration, £25 each per annum. Registered office, Queen's House, Queen Street, Cheapside, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Light, Power and Hiring Co., Ltd. (72,303).—Mortgage on lands and premises at Willesden and certain rents, &c., dated February 22nd, 1909, to secure all moneys due or to become due to Lancashire and Yorkshire Bank, Ltd., Manchester, not exceeding £9,507 8s. 11d. Also mortgage on certain electric light plant, rent, and instalments to become due in respect thereof, &c., bearing same date, to secure the same moneys.

Telephone Co. of Egypt, Ltd. (17,824).—A memorandum of satisfaction to the extent of £1,400 of £150,000 debenture stock, secured by trust deeds of July 27th, 1904, February 21st, 1906, and March 4th, 1908, has been filed.

Electrical Industries Development Co., Ltd. (89,461).—This company's annual return was filed on January 14th, when 9,007 preference and 5,000 ordinary shares had been taken up out of a nominal capital of £25,000 in £1 shares (20,000 preference); £4,007 has been paid on 4,007 preference; £10,000 is considered as paid on 5,000 preference and 5,000 ordinary. Mortgages and charges: Nil.

National Electric Engineering Co., Ltd. (42,605).—This company's annual return, made up to December 30th, 1908, was filed on February 4th; 2,659 shares have been taken up out of a nominal capital of £5.000 in £1 shares; £354 has been received, and £2,005 is considered as paid. Mortgages and charges: Nil.

Central Electric Supply Co., Ltd. (53,080).—This company's annual return was filed on February 22nd, when the entire capital of £100,000 in £5 shares had been taken up and paid for in full. Mortgages and charges: £400,000 guaranteed debenture stock.

Cordoba Light, Power and Traction Co., Ltd. (99,640).—Trust deed, dated March 12th, 1909, to secure £500,000 debenture stock and £25,000 premium, charged on the company's undertaking and property, present and future, including uncalled capital, and shares to which the company is entitled in the Cordoba Light and Power Co., of Maine, U.S.A., and the Cordoba (Argentine) Electric Tramway Construction Co., Ltd. Trustees: C. W. Trotter, 7, Moorgate Street, E.C.; and W. K. Whigham, 2, Princes St., E.C.

Brook, Hirst & Co., Ltd. (95,264).—This company's annual return was filed on January 22nd, when 12,500 shares had been taken up out of a nominal capital of £20,000 in £1 shares; £12,500 has been received. Mortgages and charges: £7,000.

Delhi Electric Tramways and Lighting Co., Ltd. (88,758).—Issues on May 14th, October 29th and December 22nd, 1908, and February 18th, 1909, of debentures amounting in all to £1,400, part of a series of which particulars have already been filed.

Voss & Co., Ltd. (101,541).—Ten per cent. debenture dated March 2nd, 1909, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Civil Service Bank, Ltd., 10, Charing Cross Road, W.C.

Hudson & Bowring, Ltd. (75,213).—This company's annual return, made up to December 25th, was filed on January 22nd. 3,142 shares have been taken up out of a nominal capital of £3,300 in £1 shares; £987 has been received, and £2,155 is considered as paid. Mortgages and charges: Nil.

Church Stretton Electric Supply Co., Ltd. (80,857).—Equitable charge on land and premises at Church Stretton, Electric Lighting Order and the general assets, present and future, including uncalled capital, dated March 17th, 1909, to secure £100. Holder: E. Bond, 43, Thurloe Square, S.W.

Nairobi Electric Power and Lighting Co., Ltd. (87,728).—Issue on March 18th of £800 2nd debentures, part of series created April 8th, 1908, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Marconi's Wireless Telegraph Co., Ltd. (53,403).—A memorandum of satisfaction, to the extent of £500, on December 4th, 1908, of mortgage dated September 30th, 1908, securing £1,465 15s., has been filed. (Notice filed March 18th, 1909.)

Egerton & Co., Ltd. (66,172).—This company's annual return, made up to February 15th, has been filed. 1,511 shares have been taken up out of a nominal capital of £2,000 in £1 shares. £1,511 has been received. Mortgages and charges: Nil.

London Sherardising Co., Ltd. (89,533).—This company's annual return was filed on February 5th, when 16,750 shares had been taken up out of a nominal capital of £20,000 in £1 shares. £3,750 has been paid and £13,000 is considered as paid. Mortgages and charges: Nil.

Durham Collieries Electric Power Co., Ltd. (83 421).—Particulars of £50,000 prior lien bonds created January 15th and secured by trust deed dated March 11th, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £4,000. (Balance to be issued as occasion arises for capital expenditure.) Property charged: The company's assets, present and future, including leasehold buildings, rights, &c., in Durham (any plant, &c., belonging to the Newcastle-upon-Tyne Electric Supply Co., Ltd., expressly exempted), certain shares and debentures, and a charge for £7,688 (ranking in priority to first mortgage debentures). Trustees: A. W. Tait and L. D. Cunliffe.

CITY NOTES.

English Finance and German Machinery.

It will be remembered, no doubt, that when the Victoria Falls Co. some time ago sought to persuade the British investor to take part in its great enterprise, we pointed out in the strongest possible manner that it was seeking to establish itself by means of a magnificent title, and that there was not the remotest intention to transmit electrical energy from the Falls to the Rand. So that there shall be no misunderstanding in the minds of our readers, we will point out exactly what this concern has accomplished. Having secured the aid of English finance it set to work not to transmit electrical energy over a distance of 600 miles, but to consolidate its position on the Rand by enlarging the existing works, and when seriously threatened by the Vereeniging scheme under the auspices of Lewis & Marks, bought out the opposition, and was in consequence still further committed to confining its power stations to the Transvaal. There are some very superior people connected with the Victoria Falls scheme, and the lofty attitude which they have always taken up quite precludes them from stating why they have not fulfilled the promises of the original prospectus, through which it may be fairly claimed a good deal of money was subscribed. Notwithstanding the concessions which the company obtained, and which were claimed absolutely to secure prosperity, it was not long before another disturbing factor arose in the situation. In the early part of last year the Rand Mines, Ltd., granted a concession, under which they undertook to take the whole of their power requirements from a company to be afterwards formed. As this demand for energy approached the neighbourhood of 200 million units per annum, it was not surprising that financial support was immediately forthcoming, but this rival scheme filled the Victoria Falls Co. with an extraordinary amount of alarm, and by every means they sought to assure the shareholders that the rival venture was based on utterly absurd foundations, and not in the least likely to injure them. With a surprising degree of virulence, the directors of the Falls Co. stated that the contract price at which the Rand Co. was to obtain electrical energy was a ruinous one, and could not possibly be undertaken by an electrical power company, with any chance of showing a profit.

Then, with one of those remarkably quick changes which can only be accomplished after much practice, the Victoria Falls Co. suddenly announced that they had taken over this new concern with the absurd concessions and low prices, and it is now sought to complete this transaction by asking that simple person who keeps the Englishman's home to find £900,000. In short, the Victoria Falls Co. which, as a concession to its interests in the Transvaal, is now going to call itself the Victoria Falls and Transvaal Power Co., has issued a new prospectus, in which 900,000 6 per cent. cumulative preference shares are offered for subscription. The prospectus further states that subscriptions for an issue of £900,000 5 per cent. debentures at 94 per cent. have been guaranteed conditionally upon the allotment in full of the present issue of preference shares. The full prospectus reveals the fact that agreements have been entered into with the Deutsche Bank, the Dresdner Bank, the Allgemeine Co., and Siemens-Schuckert, so the presumption is that our German friends will again show their confidence in the undertaking by taking the debenture stock. And the English investor is asked to show his confidence by subscribing the preference stock.

We do not suppose that the average investor for a moment realises exactly what he is doing when he pours his subscriptions into the coffers of this company. From a mere investment point of view he may be justified in putting his savings into this gigantic power scheme. But we think he would be uneasy in his mind if he appreciated the fact that by so doing he was hammering a nail into the coffin of the British electrical industry in South Africa. And in truth that is really the case. For years past the principal electrical firms have been enduring heavy expenditure in the Transvaal in the hope that when brighter times prevailed they would obtain some recompense. The power supply in the Transvaal is now mainly in the hands of the Victoria Falls Co., which means that the whole of the electrical machinery required in this colossal undertaking will be made in Germany. It may be argued that the mines themselves are free agents, and that they are not compelled to buy their motors in Germany even if they purchase power from a Germany company. For ourselves, we are under no delusions in regard to this, and the German manufacturer would be less clever than we thought him if, with his opportunities, he permitted such a valuable section of the work to slip out of his grasp. At any rate, he has shown little disposition hitherto to let the grass grow under his feet. We are not blaming the German electrical firms; on the contrary, they are to be congratulated upon the organisation and acumen which enables them to control a so-called British company in a British Colony. At the same time, while we have all along appreciated that the Victoria Falls Co., despite its cosmopolitan directorate, was German to the core, and while most electrical men were also aware of the fact, the average investor does not know it, and the daily Press is too much taken up with other matters to tell him.

It is disappointing to realise that however good may be the concessions controlled by the Victoria Falls Co., and there are engineers who consider some of them really good, it must remain an incontrovertible fact that while English investors are asked to take all the risk, there is not the slightest intention to give home manufacturers one single order for electrical machinery. The whole story only goes to show what a complete lack of relationship there is between English finance and industrial interests. With the enormous demands which are made upon British capital from all quarters of the globe, and usually for the

purpose of carrying out work involving important industrial operations, it is extraordinary that there cannot be devised some means by which the persons who find the money should make a point of safeguarding the home industries.

Liverpool District Lighting Co., Ltd.

The annual meeting was held at Liverpool on March 31st. Col. A. H. Holmes, who presided, said that the large development of the company in the electric lighting of the city had outrun the present capital, which was a very serious matter for a company such as theirs, which had prospered steadily and paid its dividends regularly. They had not thought it proper to pay this half-year the usual dividend of 5 per cent. Proceeding, the chairman said the reason for the diminution in the quantity of electricity supplied, as compared with the increase in the number of lamps was really a matter for congratulation, as they might be certain the number of the customers would enormously increase when it was discovered that the new lamps now coming into general use consumed such a small quantity of electricity as to make the electric light quite the cheapest illuminant. In fact, there could be no doubt that in the near future a supply of electricity would be as necessary to a house as a supply of water, and would be used for light, heat, cooking and small machines. It was this circumstance that made him feel confident. They might look forward to a very large increase in the number of lamps connected with the mains and a considerable increase in the electricity supplied, and, of course, in the revenue to be derived therefrom. They might, therefore, be sure that the prospects of their company were good, but they must remember they were under the legal obligation to supply electricity as demanded, and, to do this, must have additional capital. The directors were anxious not to burden the original shares by borrowing in debentures, and he had no doubt that an appeal to the shareholders to raise a further £5,000 would meet with a satisfactory response. In dealing with other matters, the chairman said they had put down new water-tube boilers, and were greatly indebted to Mr. Holbrook Gaskell for his suggestion and advice in regard to the installation. The use of these boilers had effected a saving of £231 in the past three months.

Mr. McLaren seconded, and the report and financial statement were adopted.

A resolution was carried declaring the payment of a dividend of 3 per cent. for the half-year, making 4 per cent., with the interim dividend for the year.

Folkestone Electricity Co., Ltd.

At this company's meeting, Alderman Spurgen, in moving the adoption of the report (see Electrical Review, March 26th, page 526), referred to the progress of the undertaking. Their policy had been to cut down expenditure as far as was prudent, but with increased business they had increased expenses, and it was also necessary to raise further capital. During the year they had obtained 240 new customers, making in all 2,555, and there had been an increase equivalent to 7,690 8-c.p. lamps. This he regarded as most satisfactory, considering that no new houses had been built in the year, but it was gratifying to hear that several of those which had been long unoccupied had found tenants, and prospects were improving. There was also a promise of revival in the building trade, and new houses meant new consumers for the company. Their coal bill was £630 higher than in the previous year, but the price was now easier, and they had thought it wise not to enter into a long contract, but to buy coal by the cargo. They were told that the Kent Collieries would certainly be putting out coal before long, and that would mean decreased cost for the commodity. They had not been much affected so far by the introduction of the metal-filament lamp, and he did not feel able to express any opinion as to the effect of the proposed Daylight Saving Bill, supposing it became law. On the whole, the outlook for the company was very favourable. The directors proposed to issue at once £10,000 of new 4½ per cent. debentures. The company had to pay 4 per cent. on their overdraft. The report was adopted.

Mr. Young called attention to the great loss of energy, which was equal to one-fifth of the quantity generated, and it increased year by year.

The Chairman replied that it could not be accounted for. Every effort was made to curtail it. A good deal was lost at Hythe, where they had a sub-station and a transformer at a great distance from the central station.

River Plate Electricity Co., Ltd.

The sixth annual general meeting of this company was held on Monday at the offices, 62, New Broad Street, E.C., Mr. M. W. Mattinson presiding.

The Chairman, in proposing the adoption of the report (which was briefly mentioned in the Electrical Review, April 2nd, page 567), said that the past year had been a bad one for joint-stock enterprises generally, which in the great majority of cases had had to submit accounts showing reduced profits, and shareholders had had to accept reduced dividends. There were always exceptions to all rules, and he was glad that that company was without the rule and not within. The profits for the year, after providing for debenture interest and all depreciations, amounted to £28,183, as compared with £17,290 in the previous year, an increase of £4,523. That advance of profits followed the progress made in other years. Since the company's incorporation six years ago they had shown a steady rate of progress. In 1903 the profits were £8,828; 1904, £10,436; 1905, £11,879; 1906, £12,018; 1907, £17,290, and this year £21,813. That was a very gratifying record of progress showing continued prosperity without a break. He would not make any prediction as to the future, but he was glad to say that the outlook for the coming year was entirely satisfactory. They would this year have the advantage of cheap coal, and as a matter of fact, already they had received by cable the approximate figures for the first three months of the current year. These figures showed an important advance upon the net figures for the corresponding period of last year, and without being unduly sanguine, he thought he could say that at the end of this year he would be able to congratulate them on the fact that the company had maintained its progress, and that the profits were in advance of the year under review. As the shareholders were aware, the company was partly an investment, and partly a manufacturing concern. They had a large interest in two undertakings in the Argentine, and the receipts from investments last year were £9,673, as against £9,913 in the previous twelve months. The slight reduction was entirely accounted for by the fact that the company had no free cash balances from which they derived any interest. The receipts from investments were within £200 of the total debenture interest in their company, which meant that nearly the whole of the profits derived from their own undertakings were available for the general purposes. Referring to their own concern, the station at Tucuman had made a slight movement toward contributing to the revenue of the company. They had sanctioned expenditure for the installation of condensing plant at that station. At La Plata they had put in another dynamo of 750 kw., and they would also have another condensing plant put in. As to the proposals for the creation of more capital, he would just refer to what had been done since the company started. They now had plant laid down at La Plata equal to 2,500 kw., and at Tucuman 700 kw., a total of 3,200 kw. They had changed the system of supply from alternating to continuous. At La Plata they had installed a plant for dealing with public lighting, and they had some 700 arc lamps connected. When they first started they had 1,200 customers, and now they had 3,600. Those improvements and extra demands on their undertakings meant a large expenditure of money, in fact, it was obvious that something like £170,000 had been expended. A very large proportion of their capital expenditure had been contributed out of the earnings of the company. For the first two years they paid no dividend, the next year it was 2½ per cent., and although the next two years they had paid a dividend on a liberal scale, it had only been after providing substantially for reserves and depreciation. The board, however, considered that the time had now come when the company should not be crippled for the want of more money. They would not increase the ordinary shares beyond the £120,000 already issued, but they asked the preference shareholders to consent to an increase of the preference shares from £100,000 to £150,000.

Mr. Robt. Miller seconded the motion, and the report was adopted.

At an extraordinary general meeting of the company subsequently held, resolutions were passed authorising the creation of 50,000 new preference shares of £1, to rank *pari passu* with the existing shares of the company.

Cuba Submarine Telegraph Co., Ltd.—The report for the half-year ended December 31st shows total receipts of £14,858, while the expenses amounted to £6,026, leaving £8,832, plus £6,756 brought forward, giving a total of £15,589 to be dealt with; £1,000 has been added to the reserve fund, which now stands at £111,000. The dividend on the preference shares will absorb £3,000, and leave £11,589, out of which the directors recommend the payment of a dividend at the rate of 6 per cent. per annum on the ordinary shares, free of income-tax; the balance, £6,789, being carried forward. The cables continue in good working order.

Stock Exchange Notices.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

Cordoba Light, Power and Traction Co., Ltd.—399,447 shares of £1 each, fully paid, Nos. 1 to 399,447; and £200,000 five per cent. debenture stock.

Highlands and Lowlands Para Rubber Co., Ltd.—123,546 shares of £1 each, 12s. 6d. paid, Nos. 1 to 7 and 181,462 to 305,000; and 182,952 shares of £1 each, fully paid, Nos. 8 to 181,451 and 305,001 to 306,498 (special application).

Anglo-American Telegraph Co., Ltd.—The directors have resolved, after placing £5,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending March 31st, 1909, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable on May 1st.

Bath Electric Tramways, Ltd.—The report for the year shows that the receipts were £38,394, and the gross profit £12,137, plus £2,489 brought forward, making £14,626. The debenture and other interest absorbs £6,383, and the directors have for the first time to provide £1,000 as a first instalment of a sinking fund for the first mortgage debentures. There is divided on the preference shares £3,750, leaving £2,493, which is to be carried forward.

Metropolitan Electric Tramways, Ltd.

The report for 1908 states that the revenue amounted to £331,836, including £7,850, the portion of the dividends received in 1906 from the North Metropolitan Tramways Co., which was reserved, and is now brought into the present account. The traffic receipts amounted to £300,013, and show a satisfactory increase of £55,813. After deducting all expenses chargeable to revenue, including £16,566 for reconstruction and renewals of the lines, and writing down preliminary expenses and other items by £3,096, there is a surplus of £46,562, making, with £5,755 brought forward, £52,318. The directors recommend placing to reserve account £6,000, dividend on the preference shares for the year (already paid) requires £25,000, and a dividend which is recommended on the ordinary shares at the rate of 4½ per cent per annum, requires £17,610, leaving to be carried forward £3,707. At December, 1908, the share and debenture capital was as follows:—£500,000 in 5 per cent. cum. pref. shares, £391,337 in ordinary shares, and £314,016 in deferred shares, all of £1 each and fully paid, £519,400 in 4½ per cent. first debenture stock, and £76,200 in 3½ per cent. first debenture stock. The directors have created and issued as security for temporary loans, £200,000 4½ per cent. second debenture stock.

Under the terms of the first debenture stock trust deed, a sum of £4,262 was last year paid into a sinking fund account in the joint names of the trustees and the company for the redemption of the issued stock, and was applied in the purchase and cancellation of £4,400 stock. From the commencement of the present year the £76,200 3½ per cent. debenture stock issued in 1906, in exchange for a like amount of 3½ per cent. debentures of the North Metropolitan Tramways Co., ranks for interest at the rate of 4½ per cent. per annum.

Three short sections of light railway in the districts of Cheshunt, Wembley and Willesden were opened for public traffic during the past year. The route mileage of lines now operated by the company amounts to 42½ miles. The County Council of Middlesex are proceeding with the construction of the remaining portions of their authorised light railway system, and it is anticipated that 10 further miles of route in the districts of Enfield, Acton, Willesden, Friern Barnet, Hendon and Finchley will be completed before the end of this year. Twenty-five new cars were purchased last year to provide for the increasing traffic requirements of the lines then opened. A similar number will be required this year, in view of the impending completion of additional lines. Central repair shops are being built on the vacant land behind the Hendon depôt. It is expected that the establishment of these central repair shops will result in a substantial reduction in the cost of the maintenance of the rolling stock.

The agreement with the L.C.C., under the terms of which the company had for three years the exclusive use of the short length of tramway in the Archway Road, Highgate, expired in December last, and negotiations have just been concluded for its renewal for a term of five years from January 1st, 1909. The B. of T. have confirmed and issued an order, under the title of the County of Hertford Light Railways (Watford and Bushey Extensions, &c.) Order, 1908, authorising the construction of light railways in the districts named, to be leased to and worked by the company. Reference was made in the previous report to the impending purchase by the L.C.C. of a portion of the company's tramway in the Harrow Road, and to the promotion by the company of a Bill in Parliament to authorise (*inter alia*) an extension of that tramway to the Edgware Road. The Bill, which received the Royal assent on August 1st, 1908, authorised the construction of the extension, subject to the consent of the L.C.C. Heads of arrangements, which, however, are subject to the sanction of Parliament, have now been agreed, whereby the new tramway is to be constructed by the company, and, when completed, will be purchased by the Council, who will thereupon grant the company running powers over both the new and old lines until December 31st, 1930, the Council reserving the right to determine the arrangements at the end of the first 7 and 14 years upon payment to the company of the sums of £2,500 and £1,500 respectively.

The company's holding in the North Metropolitan Electric Power Supply Co. consists of 40,000 shares of £10 each, of which 30,000 are fully paid, and the balance £5 paid. There was also due to the company at December 31st last a sum of £28,500, representing temporary advances made to the Power Supply Co. The revenue of the Power Supply Co. continues to show a satisfactory expansion, the number of units sold during 1908 exceeding 14,000,000. The dividend receivable for the past year amounts to £17,500, being at the rate of 5 per cent., as against 4 per cent. for the preceding year. Apart from the supply to the tramways and light railways, the Power Co.'s operations extend over the districts of Stoke Newington, Willesden, Hendon, Tottenham, Edmonton, Enfield, Barnet, Hertford and St. Albans. The supply at St. Albans was commenced during the past year, the electricity being generated by the Power Supply Co. and sold to the distribution company. The number of power consumers supplied direct by the company is steadily increasing. The Power Supply Co. is promoting a Bill in the present session of Parliament to extend the district in which it is authorised to supply for power and lighting purposes, and to provide for an increase of capital.

	1907.	1908.
Miles open (at December 31st)	40·75	42·375
Number of passengers carried	48,242,404	57,369,307
Number of car-miles run	5,037,204	6,361,253
Average receipts per car-mile	11·63d.	11·32d.
,, ,, passenger	1·21d.	1·25d.
Number of cars in stock (at December 31st)	187	212

North Metropolitan Electric Power Supply Co.

The directors' report for the year, which was presented at the annual meeting held on Tuesday, states that the revenue for the year amounted to £74,874, an increase of £15,498 over 1907, and the expenditure was £43,213, being £6,961 in excess of 1907. The balance at the credit of the account is £31,661, which compares with £23,121 in the previous year. This balance, together with sundry receipts and the amount brought forward from last account, makes a total of £34,735. After providing for debenture and loan interest, and a reserve for the redemption of debentures, there remains an available balance of £23,104. The directors recommend a dividend at the rate of 5 per cent. per annum, requiring £17,501, placing £5,000 to the credit of the depreciation account, and carrying forward £603. The capital expenditure during the year amounted to £61,885, and the total is now £495,706. The paid-up share capital remains the same as at December, 1907, viz., £350,020. £126,500 5 per cent. mortgage debentures have been issued. The total number of units sold during the year was 14,069,611, which, compared with the previous year's figure of 11,183,316, is an increase of 2,886,295 units, or 25·7 per cent. The revenue from the sale of energy shows an increase of 26·4 per cent. over 1907. The Hendon Electric Supply Co., Ltd., has taken a steadily increasing supply of electricity in bulk throughout the year. The supply for "power" purposes has considerably increased, and there is every indication of a large development of the company's business in this direction. The generating station and refuse destructor at St. Albans commenced working on September 18th last. The results have been satisfactory, and it is anticipated that it will shortly be necessary to install additional plant. The installations connected to the Edmonton electric supply undertaking mains during the year were equivalent to 4,356 30-watt lamps, making a total of approximately 7,000 lamps connected to December 31st last. The installations connected to the mains of the Tottenham electric supply undertaking during the year were equivalent to 7,026 30-watt lamps, making a total of approximately 7,500 lamps connected since the commencement of supply on December 1st, 1907. The business of the North Metropolitan Electrical Power Distribution Co., Ltd., has expanded satisfactorily during the past year, the total connections to the mains at December 31st last being equivalent to approximately 45,100 30-watt lamps, compared with 32,750 lamps at December 31st, 1907.

At an extraordinary general meeting convened for that purpose, the shareholders approved of a Bill which has been deposited in the present session of Parliament to improve the existing powers of the company in certain respects and to increase the authorised capital. The Bill has already passed a Select Committee of the House of Commons.

Anglo-Argentine Tramways Co., Ltd.

We gave last week the principal financial figures of this company for the year 1908. In the directors' report the following further particulars regarding the company's doings are given.

Contracts have been entered into for the acquisition of the undertakings of the Buenos Ayres Grand National Tramways Co., and La Capital Traction and Electric Co., Buenos Ayres, which comprises the La Capital Tramways, the La Capital (Extensions) Tramways, and the Buenos Ayres New Tramways.

The acquisition of these systems, together with the tramways of the City of Buenos Ayres Co., which were acquired in June, 1904, of the Buenos Ayres and Belgrano Co. acquired in July, 1907, and of the Buenos Ayres Electric and Belga-Argentine Companies acquired in June, 1908, completes the contemplated scheme of amalgamation.

In order to give effect to the amalgamation a "New Fusion Concession" has been granted by the municipality of Buenos Ayres. The company's Bill embodying its scheme for the rearrangement and reorganisation of the company's capital has passed through the House of Lords, and so soon as it becomes an Act, the rearrangement and reorganisation can be completed.

With a view to the payment off of the debentures, &c., of the purchased companies, and for the general requirements of the company on capital account, the directors in January last sold to the Law Debenture Corporation £3,487,444 of 4 per cent. debenture stock. This stock together with £565,000 previously issued and £413,230 given in exchange for the 6 per cent. debenture stock, completes the total amount of 4 per cent. debenture stock authorised to be issued, viz., £4,465,674. The allotment of third preference and ordinary shares to be made in respect of the Grand National and La Capital purchases referred to above, will also complete the issue of the authorised shares of those classes. At the request of the holders of the ordinary shares, a resolution will be submitted for the payment to the chairman of a sum of 5,000 guineas as a mark of appreciation of his valuable services in connection with the negotiation for and the acquisition of the various undertakings which have been purchased by the company during the period from 1904 to the present time.

The following are extracts from the general manager's report:—

The City of Buenos Ayres continued to develop at the same if not a greater ratio than hitherto. . . . This, of course, means increased traffic for the tramways after a very short space of time, as buildings spring up in a very few weeks.

In the neighbourhood of the oldest established suburban lines there are now few large tracks of land left to be split up, but on the newer lines, which are beginning to develop rapidly in this manner, there are still immense districts lying waste, and we may therefore look forward to continued and rapid increase in the traffic of the latter, especially in the cases of lines which have only recently, and as a result of the fusion, been able to reach the centre of the city.

The total increase in the number of passengers carried by all the companies during the year 1908 over 1907 was 27,802,868. Of this figure 16,337,068 correspond to the Anglo-Argentine, including for comparative purposes the systems of the Buenos Ayres and Belgrano, Buenos Ayres Electric and Belga-Argentine for the whole year, although these were only actually incorporated on July 1st.

The method of dealing with the permanent way in streets where the surface pavement has to be renewed or new pavement is being constructed, adopted in former years, has been continued through-

out the year, and in many streets where the state of the concrete beam rendered heavy repairs necessary, this method has been adopted without waiting for the entire renewal of the pavement, temporary portable tracks being laid in almost every case to deviate the traffic and allow the concrete to settle properly.

Forty-five curves were renewed during the year, also 69 crossings, 70 frogs and 46 switches.

Much has been done by the authorities to improve the maintenance of the pavement.

Repairs in the overhead installation were carried out during the year wherever necessary, and the renewal of trolley wires was continued as hitherto, 14,764 metres of wire being changed in 1908.

The underground cables in general worked satisfactorily.

The number of cars requiring repainting was very great, and in view of the large economy to be effected, it was decided to make a trial of the system of varnishing the plain timber, without using paint, and many cars were dealt with in this manner during the year.

The consumption of current which had already been considerably reduced on the Anglo-Argentine lines was brought still lower through systematic and organised inspection, and the difference on the Belgrano and other systems was very marked indeed, this being the direct consequence of the adoption of the system in force on the Anglo lines which had already given good results.

The number of accidents and collisions has diminished very considerably, due to a better disciplined staff.

The prospects of an increase of commercial prosperity for the year 1909 are very promising. The wheat harvest is quite as large as last year, and the maize, which is not yet harvested, is said to be far superior to any year, climatic conditions having been all that could be desired, and the area sown considerably increased.

The result of the incorporation of other systems will be a complete reorganisation of almost all the routes, in combination with the Anglo-Argentine system. Mutual competition will be suppressed as far as possible, new routes will be established, and new districts will be opened up by direct connection with the centre, hitherto lacking, and important centres not at present connected will be joined by direct routes. The work to be done is so important that it will occupy during the whole of the year 1909 and probably the early months of 1910; but once the system is complete and the new routes well known to the public, there can be no doubt that the company will reap the benefit, especially in the year 1910, during which will be celebrated the centenary of this Republic, when it is anticipated the movement will be very great. The following is a comparative table:—

Year.	Receipts.	Expenditure.	Passengers carried.	Miles runs.	Receipts per mile.	Expenses per mile.	Cars in stock.
*†1905 ..	£720,488	£464,872	82,442,410	13,046,851	13·25d.	7·63d.§	902
*†1906 ..	£819,219	£532,597	98,794,488	14,088,770	13·95d.	7·95d.§	778
‡1907 ..	£1,009,568	£654,076	118,945,752	16,861,707	14·87d.	8·88d.§	1,089
**1908 ..	£1,262,759	£790,687	142,939,805	21,250,182	13·87d.	8·16d.§	1,245

* Mixed traction—horse and electric. † Combined systems of Anglo-Argentine and City of Buenos Ayres Companies. § Does not include depreciation renewals funds. ‡ Includes "Anglo" and six months "Belgrano" systems. ** Includes Belgrano system for the year and Buenos Ayres Electric and Belga-Argentine systems for second six months.

Wycombe (Borough) Electric Light and Power Co., Ltd.

The directors' report for 1908 says that further progress has been made, the connections having risen from 47,941 to 49,648, being an increase of 1,707 equivalent 8-c.p. lamps. Including a balance of £39 brought forward, there is a profit to the credit of net revenue account of £4,531, and after paying interest on debentures and outstanding accounts £3,054, there remains £1,477 available for distribution. A dividend at the rate of 2 per cent. for the year is recommended, absorbing £800; £600 is to be placed to the reserve fund for renewal account, leaving a balance of £77 to be carried forward. The following is a statement of electricity generated, sold, &c.

Quantity sold—Public lamps	134,032
By contract	217,085
Private consumers by meter	417,492
Total sold	768,609
Used on works	96,967
Distribution loss	51,967
Quantity accounted for	917,563
Not accounted for	44,359
Public lamps	12 arcs, 349 Nernst
Total maximum supply demanded, kw.	483

Windsor Electrical Installation Co., Ltd.

The directors' report for 1908 states that the number of lamps and motors installed at December 31st, 1907, was equivalent to 42,171 lamps of 8 c.p. During the year the equivalent of 2,920 were added, making a total equal to 45,091 8-c.p. lamps at the end of the year 1908, of which 4,975 represent motor power. The capital expenditure during the year amounted to £815, making the total £84,769. The profit for the year, including £195 brought forward, was £5,592, being an increase of £663 in net profit over 1907. From this the following sums have to be deducted:—Debenture interest, £810; dividend on 5 per cent. preference shares, £985; depreciation, renewal and reserve fund, £1,000; directors' fees, £350; leaving £2,447. Out of this the directors recommend that a dividend of 4 per cent., less income-tax, be paid on the ordinary shares, the balance of £547 to be carried forward. The Slough and Datchet Electric Supply Co., Ltd., has also been more successful, and this company will receive a dividend of 4 per cent. on their investment in that company as compared with 3½ per cent. for the year 1907. Mr. E. MacGregor Duncan, M.I.E.E., consulting engineer, who resides in the neighbourhood, has joined the board.

The meeting was held on Wednesday last week, Sir Wm. Shipley presiding.

He said that there was a gratifying increase in the net revenue account of £663 over 1907. In that year they were enabled to pay 4 per cent. only by drawing a sum from the dividend equalisation account, and carrying forward a small balance. This year, although they were recommending the same rate of dividend, there was no necessity to draw from that fund, and, further, they were carrying forward a balance of £547, which was sufficient to have paid another 1 per cent. The capital outlay for the year had not been great, and the expenditure consisted chiefly of extensions to new consumers in Windsor, Eton and Old Windsor, and improvements at the works. The revenue account showed an improvement of nearly £600 through a decrease of the costs and an increase in the revenue. By the additions to be made to the reserve for depreciation, this fund would reach the substantial total of nearly £13,000, and the other reserve funds £1,500.

Slough and Datchet Electric Supply Co., Ltd.

The capital expenditure during 1908 was £1,716, making the tota £46,602. During the year the equivalent of 2,159 additional lamps of 8-c.p. were connected.

Year.	Lamps and motors connected.	Units sold.	Profit.
1906	11,326	253,041	£2,436
1907	13,072	260,248	2,222
1908	15,231	368,778	3,161

The total net profit available for distribution is £3,476, out of which there is set aside £750 to the depreciation fund, making the total £2,250. A dividend of 4 per cent., less income-tax, is to be declared. The mains, works, plant and machinery have been maintained in an efficient condition out of revenue.

Mirrlees Watson Co., Ltd.—The 20th annual meeting was held recently in Glasgow. The profit and loss account submitted showed a profit on manufacturing account of £16,167, and after providing £4,326 for depreciation, and for interest and directors' fees, a balance of £8,235 remained, which the meeting resolved should be applied as to £6,250 in paying a dividend of 5 per cent on the share capital, and as to £1,250 in providing for new tools, the balance of £1,250 (including £515 brought in from last year) being carried forward. The Chairman remarked on the improvement in the position of the company since 1900, the net gain in floating assets over liabilities being about £52,000, including £18,500 in fully-paid shares of Mirrlees, Bickerton & Day, Ltd. He also pointed out that there was now over £14,000 at credit of capital reserve account, while goodwill and patents, amounting to the sum of £10,000, had been entirely written off, and over £40,000 had been provided for depreciation.

American Telephone and Telegraph Co.—The report for the year ended December 31st, 1908, says that the net revenue was $18,121,707, out of which dividends of 8 per cent. were paid, amounting to $12,459,156, leaving a surplus of $5,662,551. With no improvement the dividend and other charges for the current year, including the increased dividend charges which would be due to the conversion of the outstanding convertible bonds into stock, if all were converted, would be provided for, leaving a handsome surplus. If the returns of the first two months are any indication, the current year will show the continued improvement shown in past years. The earnings were $27,898,970, as compared with $25,609,671 last year. Expenses amount to $2,003,956, leaving net earnings of $25,895,013. Deducting interest, $7,773,306, there remains $18,121,707. Dividends paid absorb $12,459,156, leaving a balance of $5,662,551, of which there has been carried to reserves $3,000,000 and carried to surplus $2,662,551. 26,370 shareholders have an average holding of 60 each. The balance of the $150,000,000 convertible bonds were taken by the bankers, who bought the first $100,000,000. These became convertible beginning March 2nd, 1909.

Great Northern Telegraph Co., Ltd.—The accounts show that the receipts in 1908, compared with those of 1907, have again diminished by about £30,000. As quoted in the *Financial Times*, the directors state that as a further decline of receipts is to be anticipated in the future, they intend to propose to the general meeting to pay 13 per cent. as final dividend and bonus, or 2 per cent. less than last year, making a total distribution for the year of 18 per cent. (including 5 per cent. already paid), and to set aside the usual amounts to the reserve and pension funds, namely, £55,555 and £8,333 respectively, the dividend equalisation fund being augmented with interest only.

France.—La Société des Tramways Electriques de Lille et de la Banlieu is declaring a dividend of 27 fr. per share for the last financial year—the same as for the preceding 12 months.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Mar. 31	2,330	— 110	44	59,510	— 232	..	..
†Ayr	,, 27	184	+ 2	45	12,768	— 812	8	..
Bath	,, 31	1,224	+ 27	13	7,579	+ 172	..	..
†Belfast	,, 26	3,687	+ 286	52	190,873	+ 106	37	..
†Birkenhead	,, 28	972	— 72	52	54,525	+ 136	13·62	..
Birmingham Corp.	,, 27	12,764	+ 427	52	329,929	+ 7,493	..	..
Blackpool-Fleetw'd	,, 19	417	+ 29	9	2,147	+ 229	..	..
Bolton	,, 28	4,181	— 94	52	117,632	+ 1,235	26	..
Bournemouth	,, 31	2,708	+ 77	52	82,019	— 4,009	21·96	..
Bradford	,, 27	8,699	+ 173	51	235,455	+ 520	54·9	..
†Brighton	,, 28	710	+ 7	51½	45,460	+ 866	9·5	..
Bristol	April 2	9,644	+ 685	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Mar. 26	414	— 27	12	2,564	— 57	3·65	..
Barnsley	,, 26	321	— 6	,,	1,912	— 28	..	..
Barrow	,, 26	386	— 37	,,	2,351	— 202	5·37	..
Cavehill	,, 26	124	— 8	,,	649	— 42	..	..
Devonport	,, 26	648	— 127	,,	4,375	— 542	8·85	..
Gateshead	,, 26	1,885	— 52	,,	11,549	— 152	11·25	..
Gravesend	,, 26	352	— 13	,,	2,069	— 145	6·5	..
Greenock	,, 26	891	— 39	,,	5,213	— 270	7·25	..
Hartlepool	,, 26	372	+ 11	,,	2,290	— 288	6·72	..
Kidderminster	,, 26	174	+ 13	,,	936	— 59	..	..
Leamington	,, 26	306	+ 65	,,	1,638	+ 109	..	..
Merthyr	,, 26	389	— 3	,,	2,315	..	2·9	..
Metropolitan	,, 26	10,395	+ 778	,,	61,956	+ 5,716	22	..
Middleton	,, 26	584	— 31	,,	3,319	— 192	8·5	..
Mid. Joint Com'tee	,, 26	10,646	— 99	,,	62,062	— 2,465	..	..
Oldham—Ashton	,, 26	1,047	— 77	,,	6,150	— 492	9·13	..
Peterborough	,, 26	200	— 6	,,	1,105	— 122	5·31	..
Potteries	,, 26	3,496	— 48	,,	20,515	— 1,040	29	..
Rothesay	,, 26	89	— 7	,,	524	— 29	2·75	..
Southport	,, 26	425	— 4	,,	2,544	+ 86	8·17	..
S. Metropolitan	,, 26	1,251	— 51	,,	7,568	— 107	..	..
Swansea	,, 26	1,740	+ 72	,,	10,207	+ 292	12·5	..
Tynemouth	,, 26	262	— 15	,,	1,512	— 140	3·75	..
Weston-s-Mare	,, 26	43	— 7	,,	289	— 3	3	..
‡Worcester	,, 26	466	+ 23	,,	2,691	— 61	5·75	..
Wrexham	,, 26	163	— 8	,,	1,028	— 20	..	..
Yorks. Wool. Dist.	,, 26	1,711	+ 7	,,	9,845	— 297	17	..
Miscellaneous	,, 26	354	— 35	,,	2,109	— 38	..	..
†Burnley	,, 27	1,149	— 11	..	..	..	..	..
†Burton-on-Trent	,, 28	286	— 6	52	13,614	— 71	10	..
†Bury	,, 28	1,002	— 89	51½	58,690	+ 1,519	..	..
†Cardiff	,, 27	2,000	+ 41	52	109,504	+ 250	..	..
†Chatham and Dist.	,, 25	732	+ 147	12	8,017	+ 720	14·98	2·77
Cork	April 1	851	+ 70	13	5,281	+ 176	..	..
Croydon	Mar. 27	2,525	+ 67	52	70,956	— 464	11·25	·75
†Darlington	,, 27	186	— 3	52	10,033	— 781	..	..
†Darwen	,, 26	231	..	51	12,580	— 375	4·36	..
Dover	,, 27	306	+ 8	52	10,524	— 477	4·75	..
†Dublin	,, 26	4,741	+ 137	..	57,632	— 288	54·25	..
Dundee	,, 31	2,189	— 10	45½	54,236	+ 1,998	15	..
†East Ham	,, 27	917	+ 91	52	45,537	— 393	8·43	·68
†Exeter	,, 26	250	+ 19	52	15,873	+ 453	5·5	..
†Glasgow	,, 27	16,611	— 267	..	726,854	—14,722	90·5	1·5
Hastings	April 1	1,400	— 199	..	..	..	..	..
Huddersfield	Mar. 27	3,031	+ 114	52	80,882	— 376	..	..
†Hull	,, 27	2,509	+ 12	52	127,642	— 449	⅛	..
Ilkeston	,, 31	261	+ 14	52	7,100	— 114	..	..
†Ipswich	,, 27	329	— 19	52	19,432	— 405	10·5	..
Kilmarnock	,, 27	265	— 25	45	6,717	— 339	4·25	..
†Lan'kshire Trm. Co.	,, 25	1,132	— 77	12	14,156	— 858	17	1·18
Lancashire United	,, 31	2,418	— 24	13	16,013	+ 142	..	..
Leeds	,, 27	12,225	+ 80	51	335,613	+ 2,979	96·75	·25
†Leicester	,, 27	2,123	+ 24	..	..	..	..	..
Leith	,, 27	914	— 80	45½	23,378	— 7	6	..
†Liverpool	,, 20	9,831	— 40	11½	144,944	— 492	104	..
‡L.C.C.	,, 20	63,966	+3,323	51	1,749,471	+181,094	121	4·25
London United	April 3	10,515	— 760	..	64,525	— 4,788	..	..
†Manchester	Mar. 27	14,865	+ 197	52	770,313	+15,156	90·5	6
†Newcastle	,, 27	3,752	+ 35	52	201,051	— 8,315	..	..
Newport	,, 27	1,172	..	52	33,134	— 1,230	14·5	..
Oldham	,, 21	3,661	+ 72	51	98,378	— 681	23·75	..
†Pontypridd	,, 27	380	+ 62	52	19,620	+ 5,109	5·5	1·75
†Portsmouth	,, 20	1,468	+ 30	47	91,350	— 1,516	14·5	..
Preston	,, 31	1,356	+ 21	..	..	..	..	..
†Rotherham	,, 25	598	+ 16	51½	30,952	— 218	10	·66
Salford	,, 29	8,396	— 210	52	235,737	— 1,589	..	..
†Sheffield	,, 28	5,354	— 133	..	..	..	87	1·25
†Southampton	,, 24	920	+ 78	51	58,229	+ 1,490	..	..
†Southend-on-Sea	,, 24	671	+ 118	52	21,997	+ 2,172	..	..
South Shields	,, 27	971	— 4	..	28,453	— 324	..	..
†Swindon	,, 31	121	— 25	..	..	..	..	..
Tyneside	,, 31	764	+ 91	13	4,782	+ 213	..	..
Wallasey	,, 27	855	+ 132	52	45,092	+ 2,570	..	·22
†Walthamstow	,, 27	528	+ 22	51½	31,466	+ 1,324	9	..
West Ham	,, 25	4,026	— 30	52	119,829	— 4,902	15	·3
†Wolverhampton	,, 31	743	— 60	52	42,155	— 1,658	..	..
†Baker St.-Waterloo	,, 27	3,415	+ 330	12	41,250	+ 4,290	4·25	..
†Cen. London Rly.	,, 27	5,622	— 265	12	67,671	— 5,519	..	..
†Char. +, Eus. Hmp.	,, 27	3,855	+ 715	12	45,855	+ 8,125	7.75	..
City & S. Lon. Rly.	April 4	6,524	+ 76	13	44,186	+ 761	7·3	..
Dublin-Lucan Rly.	,, 2	218	+ 23	13	1,387	+ 118	7	..
†G.N. and City Rly.	,, 27	1,510	— 140	12	19,091	— 2,316	3·5	..
†G.N., P'y. & Brmin.	,, 27	5,980	+ 445	12	70,825	+ 6,010	9·25	..
†L'pool Overh'd Rly.	,, 28	1,276	— 110	12	16,683	— 1,223	6·8	4·3
†Mersey Railway	,, 27	1,944	+ 89	12	23,318	+ 623	4·5	..
†Metropolitan Rly.	,, 28	15,545	+ 449	12	188,319	+ 5,670	24·5	..
†Met. District Rly.	,, 28	10,014	+1,006	12	117,380	+ 9,952	24	..
Anglo-Argentine	April 1	54,514	+17,662	13	347,123	+109,012	..	..
§Auckland	Feb. 26	13,767	+1,790	8	28,168	+ 2,230	..	..
Bombay (B.E.T.)	Mar. 4	5,288	+ 601	9	22,949	+ 1,547	..	..
Calcutta	April 3	6,536	+ 402	..	..	..	..	..
§Geneva	Feb.	6,537	+ 402	..	..	..	..	..
§Kalgoorlie, W.A.	,,	3,403	..	8	7,123	..	..	..
Madras	Mar. 31	1,264	+ 67	13	7,756	— 1	..	..
†Perth (W.A.)	,, 26	1,413	— 77	12	18,079	+ 161	..	..

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Saturday Afternoon.

Until the unfounded rumours regarding the health of the King were circulated on Friday afternoon, markets all round the Stock Exchange had been decidedly strong. The reduction in the Bank rate coinciding, in the same week, with the satisfactory news from the Balkans, led to a bout of buying in almost every department. It is eminently satisfactory to be able to record advances in several of the best class metropolitan electric lighting shares. The pleasure of writing about firmer prices is mitigated only by the unfortunate necessity of taking that pleasure at the very time that the Boat Race is on the point of starting.

That investors are beginning to recover a certain amount of confidence there is ample evidence in every stockbroker's office. The Budget, of course, looms just ahead, but the sting of it has already been drawn by the publication of the figures showing that the deficit will be, after all, comparatively trifling. So the capitalist, large or small, impressed by the cheapness of money, is on the hunt for cheap stock.

Electricity supply shares had, until this week, hardly moved since they enjoyed their little revival after the death of the Power Bill. The movement of the past few days is, however, an indication that this department is not ignored in the scamper for investments. Gains of 2s. 6d. are shown in Brompton & Kensington, Metropolitan Ordinary and Preference, Westminster, St. James's and Pall Mall, and City of London Ordinary, allowing for deduction of the dividend in the case of the last-named. County shares are 7s. 6d. down, but *ex* 6s., and South London Ordinary show a fall of 5s., of which 4s. is represented by the dividend payment.

The Victoria Falls Power Company has offered for subscription £900,000 6 per cent. Cumulative Preference shares at £1 each. Seeing that the existing issue stands at 19s., there is not much "turn" in the new, and the possibility of the latter falling to a small discount does not appear remote. With the Kaffir Circus in its present buoyant condition, however, the price of the Falls shares may be maintained in sympathy. Arrangements are said to be on foot for the establishment of a Rand Mines Power Supply Company, fathered by the Victoria Falls undertaking.

Mexican Light and Power Common shares are 2 points lower. Canadian General Power Common shares have shot up from 108 to 114, and the latter price is *ex* 1¾ dividend. The 7 per cent. Preference stock at 113 is *ex* the dividend, half-yearly in this instance. Montreal Light, Heat and Power Capital stock has risen to 116.

Sharp fluctuations in the price of Rio Trams have had little net effect, the price being still about 102, but Mexico Tramways hardened to 138. Sao Paulo Tramway, Light and Power shares at 156 are *ex* 2½ per cent. dividend; the interest on the 5 per cent. bonds, which stand at 100½, is payable on June 1st and December 1st. The North Metropolitan Electric Power Supply makes a good showing with its balance-sheet and report, the dividend on the Ordinary shares being raised to 5 per cent. The price of the 5 per cent. Mortgages is quoted officially at 100 to 102.

Home Railway stocks enjoyed a little flutter of advancement, although prices eased off when the rumours concerning the King's health gained currency. Still, Central London Ordinary is 2 up, City and South London gained another 10s., Metropolitan also improved 10s., and Districts 5s. Charing Cross Debenture has met Great Northern and Piccadilly Debenture, both stocks standing now on a common platform at 92, while "Bakerloo" Debenture keeps about 96. Underground Electric Railway 4½ per cent. bonds, which are worth attention as a speculative investment, have begun to move, rising 2 within the last few days to 84.

American Telephone and Telegraph Capital stock rose 1½, to 135 *ex* 2 dols., on the excellent report, which displays a very healthy expansion in the net profits. Anglo-American Telegraph Deferred stock has advanced substantially by reason of a fresh boomlet in the Yankee market. Other changes in this section are not material. Eastern Ordinary is ¼ up; Eastern Extensions continue dullish.

National Telephone Deferred rose 3½ points, the Lord Chancellor's decision in the case of the telephone monopoly being ignored as a market factor. The Preferred stock and the Third Preference shares are rather better. Manufacturing and miscellaneous issues are quietly steady, the feature being a brisk demand for rubber shares at advancing prices. Armament shares remain strong, Mr. Balfour's Guildhall speech being used as a bull point. The Stock Exchange will break up for the Easter recess in a comfortably hopeful frame of mind.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Mar. 30th.	Closing Quotations April 3rd.	Business done week ended April 3rd, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2½ — 3½	2½ — 3½	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	92 — 95	92 — 95	..	..	..	5 6 5
$181,551,400	American Telephone & Telegraph, Cap. Stock	$100	7½ %	8 %	8 %	..	135 —126	134½ —135½xd	134⅞	133⅜	..	5 18 1
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	97 — 99	97 — 99	97½	..	..	4 0 10
598,180	Anglo-American Telegraph	Stock	3½ %	3½ %	3½ %	£3 4s.	55 — 58	55 — 58	55	..	..	5 5 3
3,200,910	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	99 —101	99 —101	100	99½	..	5 18 10
3,200,910	Do. do. do. Deferred	Stock	½ %	1⅜ %	1 %	8/-	13½ — 13⅝	14½ — 14⅝	14 11/16	13 15/16	+1⅛	2 15 1
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	98 —100	98 —100	..	..	..	5 0 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7⅞ — 8⅜	7⅞ — 8⅜	7⅞	..	..	4 15 6
2,431,350	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	86 — 88	85 — 87 xd	85⅛	85½	..	4 12 0
16,000	Cuba Telegraph	10	5 %	5 %	6 %	..	7½ — 8½	7⅜ — 8½	..	..	+ ½	6 17 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	..	..	..	5 14 3
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8 — 8½	8 — 8½	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 16 6
60,710	Direct United States Cable	20	4½ %	4½ %	4½ %	4½ %	12½ — 12¾	12½ — 12¾xd	..	..	..	6 9 3
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	129 —132	129½ —132½	131	129½	+ ½	5 5 3
2,000,000	Do. 5% Pref. Stock	100	5%	5%	5%	..	85 — 87	85 — 87	85½	..	..	4 0 6
1,866,706	Do. 4 % Mort. Deb. Stock. Red.	Stock	4 %	4 %	4 %	4 %	103½ —105½	104 —106	..	..	+ ½	3 15 6
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	..	11¼ — 12⅜	11⅞ — 12⅜	12 1/16	12	..	5 13 4
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
200,000‡	East & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100½ —102½	100 —102	..	..	— ½	3 18 5
181,127	Globe Telegraph and Trust	10	5½ %	5½ %	5½ %	..	10⅝ — 10⅞	10½ — 10⅝xd	..	..	..	5 8 3
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	12½ — 13⅛	12⅝ — 13⅛xd	..	..	..	4 9 0
150,000	Great Northern Telegraph, of Copenhagen	10	24 %	20 %	20 %	18%	80 — 82	29½ — 81½	..	..	— ½	5 14 8
14,000‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	..	52 — 55	52 — 55	..	..	..	6 18 11
$41,380,400	Mackay Companies Common	$100	2 %	3½ %	4 %	4 %	70 — 77 xd	72 — 77	..	..	+1	5 8 11
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	70 — 75 xd	70 — 75	..	..	..	5 6 8
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3/16 — 3/8	3/16 — 3/8	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	3¼ — 3⅜	3¼ — 3⅜	..	..	..	6 0 9
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	3⅛ — 3¼	3⅛ — 3¼	..	..	..	5 12 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	105½ —107½ xd	105½ —107½	107⅜	106⅜	..	5 11 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	118½ —118⅝	120½ —122½	121¼	117½	..	4 18 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 11½ xd	10½ — 11½	..	..	..	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10½ — 11½ xd	10½ — 11½	..	..	..	5 6 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅝ — 5⅞xd	5⅝ — 5⅝	5⅝	..	+ 1/16	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½ %	3½ %	3½ %	3½ %	98 —100	98 100	..	..	..	3 10 0
1,716,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101⅛	100⅛	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	7 %	7 %	8 %	..	1 3/16 — 1 7/16	1 3/16 — 1 7/16	..	..	..	5 17 3
50,000	Do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	..	1⅛ — 1¼	1⅛ — 1¼	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	88	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,839‡	Reuter's	8	5 %	5 %	5 %	..	7½ — 8⅛	7½ — 8⅛	7 15/16	..	..	4 17 7
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½ %	4½ %	4½ %	4½ %	99 —101	99 —101	..	..	..	4 9 1
8,088	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6½ — 7	6½ — 7	6⅝	..	..	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4½ — 5⅜	4½ — 5⅜	5 1/16	..	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 58,008	2½	Nil	2½ %	2½ %	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 16 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	..	12⅞ — 13⅜	12⅞ — 13⅜	13 1/16	12⅛	..	5 4 8
800,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	101½	..	..	3 17
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	7⅛ — 8⅛	7⅛ — 8⅛	..	..	..	7 3 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	..	7½ — 8½	7⅜ — 8½	..	..	..	2 14 1
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

330,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	9 %	10 %	8⅞ — 9⅛	8⅞ — 9⅛	..	..	..	5 9 7
260,007	Do. 6 % Cum. Prefs., 1 to 260,007	5	5⅞ %	5⅞ %	5⅞ %	6 %	6 — 6½	6 — 6½	..	..	..	4 16 0
266,600	Do. Old, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	.. ..	.. ..	..	..	..	4 4 6
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	..	4⅛ — 4⅜	4 3/16 — 4 5/16	86/10½	84/6	— 1/16	4 18 5
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	3 18 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	..	1½ — 1⅝	1½ — 1⅝	38/9	..	..	20 0 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2⅝ — 2⅞	2⅝ — 3⅛	68/1½	..	..	10 15 4
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3¾ — 4	3¾ — 4	..	..	..	7 10 0
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾ — 4½	3¾ — 4½	..	..	..	4 8 11
124,400	Do. do. 5½ % Loch Leven Debs.	100	..	5½ %	5½ %	5½ %	96 — 98	96 — 98	..	..	..	5 12 3
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	142 —146	142 —146	144½	..	..	5 9 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	120 —124	120 —124	..	..	..	4 16 9
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	105½ —107½	106 —108	..	..	+ ½	4 12 7
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½ %	4½ %	4½ %	4½ %	102½ —104½	102½ —104½	..	..	..	10 15 8
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½ %	4½ %	4½ %	4½ %	101 —104	101 —104	..	..	..	4 6 7
188,801	British Electric Traction	10	3 %	Nil	Nil	..	⅜ — ⅞	⅜ — ⅞	..	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	2½ — 3	2½ — 3	54/-	..	..	10 0 0
1,478,668	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	5 %	87 — 91	85 — 89 xd	..	..	..	5 12 4
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½ %	4½ %	4½ %	4½ %	70 — 75	70 — 75	..	..	..	6 0 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7½	6¾ — 7⅛	..	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅝	6 — 6⅝	..	..	..	4 14 1
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½ %	4½ %	4½ %	4½ %	104 —107	104 —107	..	..	..	4 4 1
208,440	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½ %	4½ %	4½ %	4½ %	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	5/16 — 7/16	5/16 — 7/16	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	..	38 — 43	38 — 43	..	..	..	9 6 0
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781	2	2½ %	Nil	Nil	..	0 — ¼	0 — ¼	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	..	0 — ¼	0 — ¼	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	57 — 62	57 — 62	..	..	..	7 5 2
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	33 — 38	33 — 38	..	..	..	10 16 10
127,610	Calcutta Trams, 1 to 127,610	5	8 %	8 %	6 %	..	4½ — 5	4½ — 5	..	..	..	6 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880	5	5 %	5 %	5 %	5 %	4⅞ — 5⅜	4⅞ — 5⅜	..	..	..	4 13 0
860,000	Do. 4½ % 1st Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	99 —102	99 —102	..	..	..	4 8 3
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9½ — 10⅛	9½ — 10⅛	10	..	..	7 2 10
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½ %	4½ %	4½ %	4½ %	105 —107	105 —107	..	..	..	4 4 1
491,223	Cape E Trams., 1 to 491,223	1	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅜ — 1½	1⅜ — 1½	33/1½	32/-	..	6 17 2
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½ %	4½ %	4½ %	..	103 —107	103 —107	..	..	..	4 4 1
1,898,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½ %	62 — 64	64 — 66	64⅜	64⅛	+2	4 13 6
558,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	82 — 84	82 — 84	..	..	..	4 15 3
558,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½ %	45 — 47	45 — 47	46⅛	..	..	5 2 0
1,480,000	City and South London Railway	Stock	13½ %	24½ %	24½ %	14½ %	28 — 29	28½ — 29½	29	..	+ ½	5 1 8
55,000	Crompton & Co., Nos. 1 to 55,000	5	5½ %	5 %	5 %	5 %	1 — 1½	1 — 1½	..	..	..	11 2 2
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	95 — 98	95 — 98	..	..	..	5 2 0

* Unless otherwise stated, all shares are fully paid † A period of nine months. ‡ From Manchester Share List

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Mar. 30th.	Closing Quotations Apr. 3rd.	Business done week ended Apr. 3rd, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1⅛ — 1¼	1⅛ — 1¼	23/6	..	..	8 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1¼ — 1⅜	1 15/32 xd	24/10½	..	..	4 16 0
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 — 104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6 %	6¼%	6 %	11¼ — 12½	11½ — 12½	..	..	..	4 16 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	4½%	4½%	..	2/32 — 3/32	2/32 — 3/32	..	..	..	20 0 0
17,139	Do. "A" shares, 01—017,139	5	4½%	4½%	4½%	..	1¼ — 2¼	1¼ — 2¼	..	..	..	8 6 9
817,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	75 — 78	75 — 78	..	..	..	5 2 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	86 — 89	84 — 87 xd	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	1/32 — 1/16	1/32 — 1/16	7/6	5/7½	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	21/3	..	— ⅛	11 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7¼ — 7⅝	7¼ — 7⅝	..	..	..	6 9 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	85 — 89	85 — 89	..	..	..	4 9 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	⅛%	Nil	3/32 — 4/32	3/32 — 4/32	..	..	..	3 6 8
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10⅝	10¼ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	+ ⅛	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	11½ — 12⅛	11½ — 12⅛	12 1/8	11 7/8	..	6 0 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	5⅛	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	106 —108	108 —108	..	..	..	4 3 4
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10%	10 %	10 %	..	15 — 16	15 — 16	..	..	..	6 5 0
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	Nil	1 — 1 1/16	1 — 1 1/16	..	..	..	5 6 8
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4½ — 5½	4½ — 5½	..	..	..	9 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	3 %	Nil	2 — 3	2 — 3	..	..	..	4 8 11
899,980	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	3½ — 4	3½ — 4	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3½%	3 — 4	3 — 4	70/-	..	..	9 7 6
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	%	4 %	71 — 76	69 — 74	71	70	—2	5 8 1
5,782,062	Metropolitan Consolidated	100	2½%	1 %	½%	½%	35½ — 36½	36 — 37	36⅜	35⅞	+ ⅛	1 7 0
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	68 — 70	68 — 70	69⅜	..	..	3 18 7
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	14 — 14⅛	14⅛ — 14⅜	14 1/8	14 1/16	+ ⅛	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	..
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	3/32 — 4/32	3/32 — 4/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/32 — 4/32	3/32 — 4/32	..	..	..	5 19 5
600,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	94 — 96	..	..	+ ⅛	4 13 9
$6,000,000	Mexico Trams Co., Common Stock	..	..	..	..	..	137—139	137 —139	139⅛	138	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91⅞ — 92⅛	93 — 94	93	92⅛	+1⅛	5 6 5
245,500	Potteries E. Tro.	1	4 %	4 %	4 %	4 %	1/32 — 2/32	1/32 — 2/32	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/32 — 2/32	1/32 — 2/32	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	88 — 91	89 — 91	..	..	..	4 18 11
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	32 — 34	32 — 34	33	..	..	5 14 10
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101½	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	101 —102	101 —103	103	..	+ ⅛	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	81 — 83	83 — 85	83¾	..	+ ⅜	5 5 11
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	27 — 29	30 — 32	..	..	+ ⅜	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	10 %	Nil	⅝ — ¾	⅝ — ¾	..	..	..	10 0 0
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	6 %	2 — 2½	2 — 2½	..	..	..	12 0 0
246,404	Do. 4 % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	68 — 72	69 — 73	..	..	+1	5 9 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5⅛%	5⅛%	5⅛%	5⅛%	4¼ — 5	4¼ — 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
80,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8½ — 8⅝	8½ — 8⅝	..	..	+ ⅛	5 14 3
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞ — 4¼	3⅞ — 4¼	80/-	75/-	..	5 17 8
80,000	Do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4½	4 — 4½	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 9 1
445,726	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	8⅜ — 8⅞	8⅜ — 8⅞	..	..	..	5 16 2
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 10⅝ xd	10⅝	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12½ — 13	12 — 12⅝ xd	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —123	121 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	3 1 6
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	3¼ — 3¾	3¼ — 3¾	..	..	..	6 13 4
220,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	96 — 98	96 — 98	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	8⅝ — 9⅛	8⅛ — 8⅝ xd	..	..	..	5 9 7
50,997	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛	10⅛ — 11 xd	10 1/8	10⅛	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	Nil	1/32 — 2/32	1/32 — 2/32	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	Nil	2/32 — 3/32	2/32 — 3/32	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 62	59 — 62	60	..	..	7 0 8
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	85 — 87	85 — 87	86½	..	..	5 14 11
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 5	4½ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	7⅞ — 8	7⅞ — 7⅞ xd	..	..	..	5 9 8
$2,400,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	96½ — 96¾	99 —101	100	97½	+2½	4 19 0
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 %	7½ — 7⅝	7½ — 7⅝	7⅝	..	..	6 1 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 96	93 — 96	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅞ — 2¼	1⅞ — 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	5 — 5⅝	5 — 5⅝	..	..	..	5 11 8
874,896	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 96	92 — 96	..	..	..	4 3 4
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	5 %	4½ — 5	4⅝ — 5⅛	95/7½	93/9	+ ⅛	4 17 7
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4½ — 5	4⅝ — 5⅛	98/7½	93/9	+ ⅛	4 17 7
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	106 —109	106 —109	..	..	..	4 2 7
248,000	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½%	3½%	3½%	3½%	85 — 88	85 — 88	..	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	86½ — 87⅞	87⅞ — 88⅝	88	87⅞	+1	5 13 0
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3½%	79 — 81	77 — 79	79½	77½	—2	4 8 7
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	108 —110	109 —111	109⅝	..	+1	6 6 2
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	89½ — 90¾	91½ — 92½	91⅝	91½	+1⅛	5 8 1
260,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	2½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	8 8 5
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5 — 5⅛	4⅜ — 5⅛	..	..	..	4 13 0
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	100 —102	100 —102	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	10⅜ — 11⅛	10⅜ — 11⅜	..	..	..	6 4 5
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6⅜	6 — 6⅛	6⅛	..	..	5 7 6
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	3 %	1⅜ — 1⅝	1⅜ — 1⅝	26/3	..	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 4 4
194,684	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100 —103	100 —103	..	..	..	4 17 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅜ — 8⅞	8⅛ — 9	8⅝	..	+ ⅛	5 11 1
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	7 — 7⅛	..	..	+ ⅛	4 13 4
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
46,700	Do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 70	68 — 70	..	..	..	5 11 1
65,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	5 %	2⅜ — 3	2⅜ — 2⅝	..	..	— ⅛	8 0 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	⅜ — ½	⅜ — ½	..	..	..	4 0 0
142,966	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	+ 1/32	5 9 10
220,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102 —105	100 —103 xd	..	..	..	4 5 9
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¾ — 1	¾ — 1 xd	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1¾ — 2	1¾ — 2 xd	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	78 — 82	77 — 81 xd	..	..	..	5 9 9
868,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	1⅛ — 1⅜	1⅛ — 1⅜	19/4½	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	8⅞ — 9¼	8⅞ — 9¼	..	..	+ ⅛	5 6 8
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5¼ — 5½	5¼ — 5½	5⅛	..	..	4 1 10

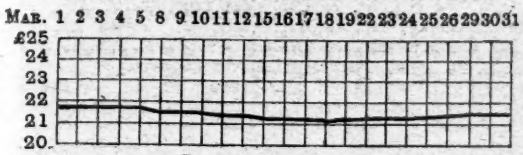
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount, 2½ per cent., April 1st, 1909.

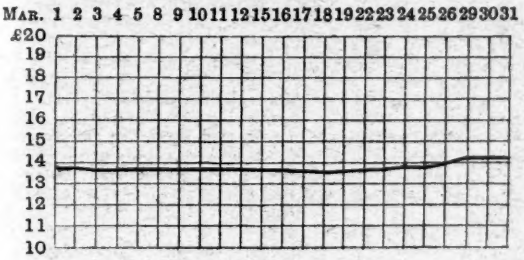
METAL MARKET.

Fluctuations in March.

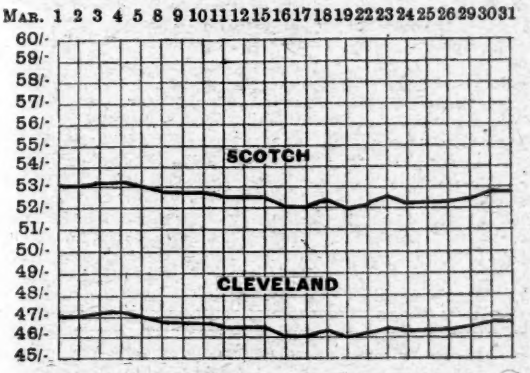
SPELTER (G.O.B's.).



LEAD (ENGLISH).



IRON.



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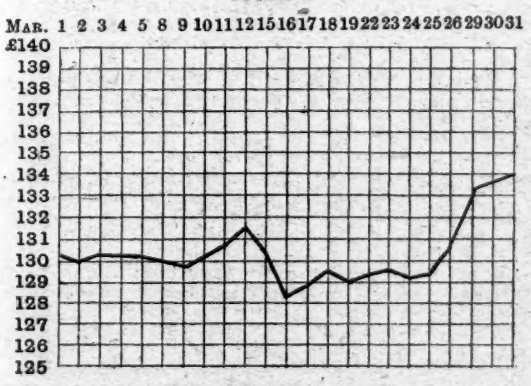

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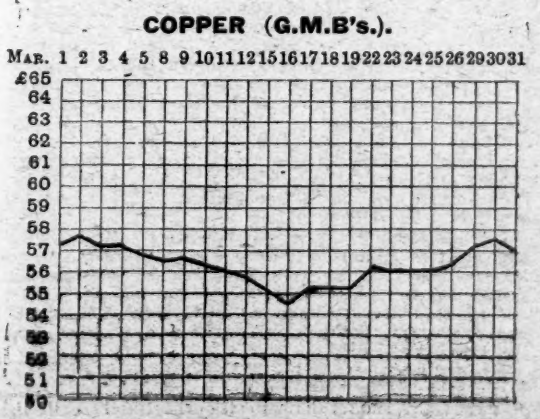

PROPOSED ELECTRIFICATION OF THE SUBURBAN RAILWAYS OF MELBOURNE, VICTORIA.

[Abstract of Mr. Charles Merz's Report.]

This report opens with a detailed and comparative examination of the local traffic conditions, and some most interesting statistics are put forward; but, on account of the decision of the Commissioners not to do anything in the way of electrification at present, we should hardly be justified in taking up space with facts and figures which may have changed materially by the time the Commissioners take a more hopeful view of the financial prospects of such an alteration.

Let it suffice that suburban travel in Melbourne on the railways and tramways has grown continuously during the past ten years, and the two systems of conveyance have shared almost equally the passengers and receipts, this being a highly exceptional state of things. The journeys per head of population have increased in that time from 159 per annum to 236 per annum, which, of course, is not large in comparison with the more densely populated capital cities of Europe.

We have in a previous issue referred briefly to this matter, but pressure upon our space has prevented us from giving it the attention it deserved until now. We shall endeavour to extract from this masterly report only those things which are likely to be of more or less permanent interest to us all.

Speaking widely, Mr. Merz says that electrical operation necessitates a higher capital expenditure than steam working, but it gives a considerable saving in running expenses, and many other advantages, of which the principal are as follows:—

From the Public Point of View.

1. Regular and more frequent service.

2. Greater punctuality. (Also possible with other forms of traction.)

3. Prevention of fires on property adjacent to the line arising out of sparks from locomotive uptakes.

4. Practical abolition of smoke, steam and dust, and a great reduction of noise.

5. Possibility of shortening the time of journeys below anything possible with steam.

6. Improved lighting and cleanliness of carriages and stations. (Just as satisfactory results could be, or are, obtained with steam.)

From the Railway Manager's Point of View.

1. Higher schedule speed, enabling a larger mileage to be obtained from a given amount of rolling stock and a greater number of trains to be operated over a given length of track.

2. Continuous and regular movement of trains, and, in consequence,

3. More economical employment of train crews.

4. Greater flexibility in making up trains, on the multiple-unit system, to meet the varying requirements of the traffic.

5. Ability to reverse trains at termini without shunting, thus reducing the time wasted.

6. Increase in capacity of termini and postponement of terminal extensions follow upon (5).

7. Elimination of the lighting up of locomotives and of the inefficient water, coal-handling, auxiliary, lighting and heating appliances.

8. Use in the power station of a cheaper fuel than can be used in locomotives.

9. Supply of electric power at a low price available for a number of purposes, such as railway workshops, cranes and capstans, for which an independent installation would not be justifiable or economical.

10. Reduction in repairs and an increased life of track due to the weight of the driving machinery being distributed throughout the train, instead of being concentrated, as in the steam locomotive.

11. Reduced cost of painting, and increased life of metallic structures near the railway, due to absence of corrosive fumes.

From a Profit Point of View.

1. Reduction of operating expenses, even for the same train-mileage, and considerably greater saving in the expenses per train-mile when the mileage is increased.

2. Increase of revenue due to an increase of traffic.

3. Improved earning power of capital sunk in lines, stations and rolling stock, due to the increased traffic capacity, thus saving capital expenditure which would otherwise be necessary to meet growth of traffic.

The critical question is, Do these advantages outweigh the heavy new capital expenditure?

Schedule speed, or average speed including stops, is one of the most important factors in the success of a railway, and on the Melbourne lines Mr. Merz intended to increase the present average of 16 m.p.h., under steam, to 20 m.p.h. under electricity. The following table gives the corresponding speeds on other important electric railways:—

Railway.	Length of single line. Miles.	Average distance between stops. Yards.	Schedule speed. Miles per hour.
Boston Elevated	16	2,400	13·0
Central London	13	840	14·0
Lancashire and Yorkshire (Liverpool and Southport)	69	2,290	30·0
Liverpool Overhead	13	670	19·0
London Metropolitan District ...	56	1,042	15·7
Manhattan Elevated	118	1,775	14·7
New York Central (New York) ...	85	4,600	21·0
New York Subway	55	2,030	16·0
North-Eastern (Tynemouth branches)	73	2,000	20·5
North-Western Elevated (Chicago) .	25	1,320	10·0
Prussian State Railways (Hamburg-Altona)	45	2,190	19·1
Pennsylvania R.R. (West Jersey) ...	160	8,800	28·3
Paris Metropolitan	30	540	16·2

The multiple-unit system of train control is recommended for reasons which are well known now.

The Government Railway Department estimated that by the year 1912 the traffic, if steam working were retained, would have increased by 20 per cent, but that the increase under electric operation would be 25 per cent, or more.

In building a time table for the Melbourne electrified service, Mr. Merz bore in mind what everyone should remember under the same circumstances—that a uniform and frequent service must be maintained throughout the day. The public then can rely on catching a train without having to consult a time table, and are encouraged to spread their custom over the day, not merely to travel at the accustomed times of rush traffic. If such a habit could be developed advantages would accrue of the same order as those which attend upon a flat diurnal load curve in a central station.

It was necessary to decide upon the best system of electric traction, and in reporting Mr. Merz has grouped the systems to which he refers, as "Conductor rail systems" and "Overhead wire systems."

As a matter of historical interest, a catalogue of the existing systems follows:—

Conductor Rail Systems.

1. *Third Rail System.*—Direct current at low or medium pressure, using an unprotected, or partially protected, conductor rail. This system has been in actual commercial operation for several years, dealing with the most severe services. It is used on the Underground Railways of London and Paris, the North-Eastern Railway, the Lancashire and Yorkshire Railway, the Pennsylvania R.R., and numerous other lines in Europe and America.

2. *Protected Third Rail.*—Direct current at low or medium pressure using a protected conductor rail. This system is in use on the New York Central Railway and the Berlin Elevated Railway, and is about to be adopted on certain of the Belgium State Railways. It may be looked upon as an improvement on No. 1.

3. *High-Tension D.C.*—Direct current at high pressure (1,200 volts or over), using a protected conductor rail. This system is to be used on certain railways in the Western States of America.

Overhead Line Systems.

1. *High-Tension D.C.*—Direct current at high pressure (1,200 volts or over). The Cologne-Bonn line is one of the best examples of this in actual operation, and has been running for three years. The system is also in use on various inter-urban roads in the United States, amongst which may be mentioned the Indianapolis and Louisville Traction Co. and the Central Californian Traction Co.

2. *Three-phase System.*—Three-phase alternating current at high pressure (3,000 volts or over), using two overhead wires for each track. This system is in successful operation, and is used largely in conjunction with electric locomotives. Notable examples are the Valtellina line in Italy and the Great Northern in the United States.

3. *Single phase System.*—Single-phase current at extra high pressure (6,000 to 10,000 volts). The best example of this for suburban service is perhaps the Hamburg-Altona line, which was first electrically operated in October, 1907. This system has also been adopted by the New York, New Haven, and Hartford Railroad on the outskirts of New York (electric locomotives being used), and by various inter-urban roads in the United States. It is also being used by the London, Brighton and South Coast Railway for one of their South London suburban lines, and by the Midland Railway Co.

As the investigation proceeded it was considered that all the systems might be put on one side with the exception of the unprotected third rail, the protected third rail, and the single-phase overhead systems.

Calculations showed that a protected rail system at 600 volts has many advantages over the unprotected system at a lower voltage, both from financial and operating points of view, so that the choice was narrowed to two systems only.

It has been claimed that even for suburban railways on which there is a frequent service, the single-phase system shows very considerable advantage in first cost, compared with the direct-current system. This, however, has not proved to be the case, after having worked out in detail the cost of dealing with the Melbourne suburban traffic, for not only would the overhead lines be very much more costly than has been stated frequently to be the case, but the additional cost of the large number of train equipments required would practically balance the extra expenditure on the sub-stations required in the case of the direct-current system; in fact, the very complete investigation which was made into the first cost of providing the electrical equipment for the Melbourne suburban railways has confirmed the opinion as to the relative first cost of the two systems which Mr. Merz had formed in investigating similar problems for the other suburban railways. In the case of Melbourne, it is only when including very long and sparsely populated lines, to which in any case Mr. Merz did not consider the extension of electrical operation justifiable, that the single-phase system shows any appreciable saving in first cost over the direct-current system.

However, when coming to consider the total annual cost (which is the important figure), including operating expenses and interest charges, it was found that under Melbourne conditions the direct-current system shows a saving compared with the single-phase system. It was, therefore, not possible to recommend the adoption of the single-phase system on financial grounds; and arguing from present practice it was seen that the only single-phase line at all comparable with the Melbourne suburban lines is the Hamburg-Altona, which is quite new. There are many instances of single-phase inter-urban lines in America, but they are of a simple nature and for the most part use single cars, not trains. Upon the New Haven line only locomotives are used.

As a mechanical structure a protected conductor rail, compared with overhead wires, is superior in both simplicity and reliability; it not only needs less repair, but less inspection, and the wear on the conductor rail is practically negligible, whereas the wear on the overhead wire is not inconsiderable. Most important of all, the inspection and repair work can be done by the ordinary permanent way staff in daylight and when the service is in full operation, whereas the inspection and repair of overhead wires requires a special staff, not only because it has to be done at night, but also on account of the class of labour required.

To guard against telephonic disturbance in the case of overhead H.T. wires expensive precautions would be necessary.

The only points about the proposed power station which we need mention are (1) that the prime movers would be steam turbines supplied with superheated steam by water-tube boilers; (2) that the pressure at the alternators would be 12,000 volts; (3) that the switchgear would be situated *in a separate building*, where the attendants are undisturbed by the noise of machinery or of accidents; and (4) that an elaborate telephone system would connect the switch room with each generating unit and with the sub-stations.

With regard to the track, the conductor rails would be laid in the six-foot way, thus leaving the tracks themselves, and the outsides of the tracks, free from obstruction. At level crossings or at special track work the conductor would be discontinued, and the gap bridged by cable laid underground.

Mr. Merz discusses the choice of rolling stock at some length, and arrives finally at the conclusion that a new design combining the advantages of the corridor and the cross compartment coaches will be the most suitable, and his reasons are worth noting.

The two chief considerations which should influence the choice of rolling stock for an important and rapid suburban service are, first, to secure the maximum passenger accommodation for a given weight; and, secondly, to increase the schedule speed by providing facilities for loading and unloading in the shortest possible time.

The first consideration is met by making each coach as large as possible, while the second is almost entirely one of arrangement of seats and doors.

The corridor car is used in America almost to the entire exclusion of any other form, and it has the advantage that the train is not delayed by the necessity of closing doors if train-men are stationed at each end of every coach; but, for ordinary suburban working, the attendant expense is prohibitive. The corridor coach also has a large standing capacity, which is a valuable feature on short runs, but, on the other hand, the seating accommodation is considerably less than in a compartment coach. Corridor stock provides facilities for changing from one car to another, so giving the opportunity for the passengers to distribute themselves after the train has started, instead of wasting time on the station platforms, and that is such a valuable attribute that Mr. Merz proposed to incorporate it in the Melbourne coaches, while at the same time retaining the cross-compartment and side door which are essential for quick loading and unloading with the least possible train staff. The use of sliding doors instead of the usual outward swinging door will enable the coach to be built of the maximum width, and will prevent delay at stations, as they can be closed by the passengers without danger even after the train starts, whereas the swinging door must be closed before the train leaves the station. Mr. Merz further points out that with the increased acceleration proposed, the speed at which the last door of the longest train would pass a point at the end of a 360-ft. platform would be 21 M.P.H., which would be too high a speed to allow a platform porter to close the doors. This objection would not apply to trains of the usual length (two cars).

The electrification of a railway and the consequent erection of a large and economical power station, enables power to be supplied for any incidental requirements at a very low price, and this use should produce not only a saving in cost compared with the old methods of producing power and light, but also a beneficial effect on the cost of producing energy for the railway itself, on account of the improved load factor.

Mr. Merz recommended that the Melbourne stations in the central area should be lit either by enclosed arcs or by groups of metal-filament lamps, and for stations outside the central area the lighting

should be done from the conductor rail, except in the case of the larger stations, where for one reason or another series lighting might be objectionable, and in these cases he would use a motor-generator and battery.

The following is a summary of some of the conclusions of general interest contained in the report, and, although they refer to Melbourne in the first place, they are of world-wide significance.

Capital Outlay.

1. The total capital outlay for the conversion of the whole suburban system will be £2,227,050.

2. In considering these figures, the expenditure necessary if steam traction be retained must also be taken into account. This expenditure, on rolling stock only, amounts to £408,358.

Cost of Electric Working.

3. The expenses per train-mile with electric traction would be 11·0d., as against 18·9d. with steam. With the former, however, there would be a greater train mileage.

4. The total operating expenses with electric traction would be £27,267 per annum less than with steam.

Financial Result.

5. The total annual expenditure, including 4 per cent. on the new capital outlay, would be £44,791 more than with steam; against this must be put the additional revenue due to the improved service.

6. The surplus, after paying interest on new capital, would, with electric traction, be £40,251 greater than was obtained in 1906 with steam.

Improved Service.

7. If electric traction be adopted, an improved schedule speed and frequency of service becomes possible, with the existing track and termini.

8. An increase of 20 per cent. over the present schedule speed, and an increase of 71 per cent. in the train-mileage are financially justifiable, and are covered by the expenses referred to above.

Rolling Stock.

9. The adoption of the multiple-unit system of train operation instead of locomotives is recommended, giving this increase of 71 per cent. in the train-mileage with an increase of only 23 per cent. in the ton mileage.

10. Cross-compartment coaches should be adopted, the existing bogie stock being altered and used for the electric service.

11. The total stock required would be 496 coaches with electric working, as compared with 546 coaches and 110 locomotives with steam, the reduction in the number of coaches being due to the higher schedule speed.

ELECTRICAL CONVENIENCES IN THE MODERN POWER HOUSE.

A recent examination of operating conditions in a number of power plants disclosed the fact that a broad opportunity exists in many modern stations for the improvement of their handling through the use of electrical conveniences of different kinds. The best thing about the matter is the trifling cost of installing these minor electrical auxiliaries, while the simplicity of their construction and arrangement is generally such as to ensure thoroughly reliable service. In many cases these devices can readily be made up in the plant itself by the regular staff of the station; complex apparatus is seldom necessary, and about all that is required is plenty of wire, some lamps, and material for the making of automatic or manual electrical contacts, with a little ingenuity on the part of the plant attendants.

One of the most useful devices in a plant covering considerable area is an electric annunciator system, which will enable any employé to be called to the chief engineer's office, wherever he may be working when he is needed. The simplest form of apparatus to effect this is, doubtless, an ordinary system of vibrating bells, located in such a way that no part of the plant is out of reach of any local gong. By assigning each employé a number, the call can be sent out from the chief's office with minimum difficulty, and the disadvantage of having to take other men away from their positions at critical times in the operation of the station avoided. The chief engineer can proceed with the work in hand in his office in such a case, without losing any time. If the plant can afford to install a small interior telephone system, so much the better. The convenience of the telephone in a large station is not easily exaggerated, and wherever such an installation is provided, provision should be made for connecting the switchboard with the engine or turbine section, and the portion of the plant devoted to auxiliaries with the latter, as well as for bringing the boiler room into close touch with the chief engineer's office and the portion of the engine floor occupied for the time by the engineer in charge of each watch. In a very large station it may pay to install a telephone system capable of satisfactory operation in connection with the local telephone exchange, but in general it is preferable to save money by keeping the plant system separated from the local service of the town, providing, however, at least one telephone in the plant connected to the town system, and therefore located in the most central operating point. Not long ago the writer saw a station of some 10,000 kw. capacity which operated the street railway system of a large city, and which was of necessity provided with both public and private telephone lines. The telephones were all located on the switchboard gallery, which was elevated at least 50 ft. above the turbine room floor. In view of this height of the gallery, it was a most inconvenient location for the telephone sets, although desirable from the operating point of view. The time lost by the chief engineer and his assistants in climbing many times a day up the gallery stairs, often for a conversation of only a few seconds, emphasised the need in this particular case of installing extension sets, and providing bell or lamp signals in the plant that could be used to call the man wanted to a point on the floor where he could telephone, instead of requiring him to use up his time and strength in stairway journeys.

It is most important in modern plants equipped with automatic apparatus of an auxiliary character to know that things are going right when no one is in sight of the machinery. In some cases, for example, it is necessary to operate fans on the forced draught system at varying speeds, depending upon the requirements of the load. In one station visited the boiler room was about 300 ft. long, and only a part of the boilers were provided with forced draught, the rest depending upon the natural air supply furnished by a large and high chimney. Under ordinary conditions of load the natural draught boilers were operated, but when the demands upon the station increased beyond the economical capacity of the furnaces and water-heating surfaces, the additional boilers were brought into use, calling for the operation of the fans by small slow-speed horizontal engines exhausting into the feed-water heating system. It was desirable in this boiler room to cut down the labour cost as much as possible, and on account of the great length of the plant, it was found possible to reduce the supervision of the machinery by installing a simple lamp circuit on each fan, fed on a 110-volt line. At each turn of the fan a contact was made in the lamp circuit, and the position of the lamp for each fan above the boiler-room floor enabled the force at the other end of the room, and particularly the boiler room foreman, to see how the fan speed was varying, by counting the flashes corresponding to the revolutions.

Although in many plants the feed pumps and condensing equipment are situated under the eye of an operating engineer who spends most of his time in their supervision, it is sometimes desirable to install a lamp signal circuit which will indicate the number of pump strokes in a given time. A miniature lamp on a reliable battery circuit, or run by power-house current through a suitable resistance to cut down the voltage, can be fitted up with little trouble and cost, and arranged to indicate either in the chief engineer's office or elsewhere, the operation of the pumps throughout the entire period of plant operation. In the same way, an indicating lamp circuit is useful when connected with the motor driving the coal crusher or conveyor. The cost of operating such a circuit is a small matter compared with the convenience of knowing just what is taking place in the less accessible portions of the station.

In stations where the machines are of large individual capacity, and where the organisation is complete, and under strict discipline, the use of electrical lamp signals fitted up as lettered transparencies may be made very valuable, particularly as a supplement to whistle or bell signals used in starting or shutting down steam turbines, and large engine-driven generators, and particularly when throwing machinery into parallel operation. In few cases thus far has the use of lettered transparencies been tried, but the

success which has attended the operation of regular engine telegraphs in plants, similar to those used on ship-board, points the way toward a most satisfactory application of the principle of the illuminated sign in the control of machinery from a central point. There would be no chance for error of interpretation in such a case, such as is inevitably present where counting of signals is necessary under conditions of operating stress.

In the operation of oil pumps, pilot lamps can be used effectively. In many plants these pumps are located in out-of-the-way corners of the basement, two or more pumps being kept in constant readiness for service, if not in actual operation. It is important to be certain all the time that the oil pumps are working properly, forcing the filtered oil regularly from the basement or engine-room floor level to a high-level tank for storage or subsequent distribution, so that if anything goes wrong, a second or third pump can be thrown into immediate service. If lubrication slows down, or if the pump equipment speeds up too rapidly, the fact becomes known at once, and steps can be promptly taken to ensure continuous service.

Safety of operation has been much increased in plants using dangerous voltages, within the last few years, through the use of red and green pilot lamps as indicators of the open or closed condition of oil switches. In the larger and later installations miniature models of the bus-bar and switch connections have been very successfully employed on the operating gallery, and by the use of remote control, the simplicity of the installation from the working point of view has been much increased. The condition of feeder circuits in railway plants, and the opening or closing of a circuit-breaker, can be much more rapidly determined when pilot lamps are available as indicators. A wise practice is to connect pilot lamps across the secondary circuits of transformers, to furnish positive evidence that the lines are in proper condition for work, especially when repairs are necessary.

In the operation of gas engines it is of considerable importance to know that the ignition proceeds at the proper rate and time in each cylinder. One easy method of accomplishing this is to install a lamp of the proper voltage in the ignition circuit of each cylinder, which can be seen from any point of the engine room. In one recent instance noted a magnet coil was installed in the ignition circuit of each cylinder, and a metallic pointer arranged to be deflected at each pulsation of the sparking discharge through the line. In the inspection of valve settings of gas or steam engines, and in the examination of cylinder interiors which is so essential to good service in all forms of internal-combustion engine equipment, the small electric flash lamp or the portable incandescent of moderate candle-power, equipped with a suitable reflector, is one of the best time savers known, in proportion to its cost. The interiors of oil switches and other mechanism located in dark places in the station can also be examined with special facility by this means.

No part of a modern power plant operated by steam is of more importance than the equipment which furnishes a supply of condensing water. In many cases this supply is drawn from an adjacent stream or lake through underground conduits leading to a pump well, where enough water is stored temporarily before its delivery to the injection or circulating pumps. It is essential to know the height of water in the well practically all the time, and to provide for the starting of pumps when for any reason the water supply gets low. With electric pumps, the installation of a float and switch which will start and stop the pumps automatically is entirely feasible, and while such apparatus costs more to develop or to purchase than many of the other conveniences which find ready use around a plant, it is worth much in the interest of continuous and economical service. A supplementary indicator operated by the float at different fixed heights is also simple and effective.

Canada.—An electric power company is seeking authority to construct dams on a number of rivers emptying into the Bay of Fundy, in order to take advantage of the power of the high tides for which the bay is famous.—*Electrical World*, N.Y.

WHO SAID OVERHEAD WIRES?

WHILE we have heard authoritatively, on several recent occasions, that British electricity supply is in a flourishing condition, it strikes one forcibly on referring to, say, our own tabulated statistics of electric supply stations, that the bulk of the populous centres where electricity supply, under present conditions, may be expected to be a paying proposition—and, indeed, many where it doesn't pay—have been catered for.

It is no secret, however, that "present conditions" have a great deal to answer for as regards the curtailment of electricity supply, perhaps more particularly in the smaller undertakings who hesitate to extend mains outside the beaten track—but, certainly, in rural townships, which cannot afford underground supply networks.

Quite recently, the Surrey township of Farnham, and its 7,000 inhabitants, appeared to be within measurable distance of obtaining an electricity supply. The local companies proposed the use of overhead distribution, and ultimately this involved the holding of a Board of Trade inquiry, into the pros and cons of which we do not intend to enter. At this inquiry, however, the assistant secretary of the Board, pointed out that the general principle of the Board was not to give sanction for overhead wires except in unpopulous places or in places where there was waste land. He also remarked that they all knew that the overhead system was a great nuisance and annoyance in towns where there was a great deal of traffic, and further, that the feeling of the Board was rather against overhead wires for electric lighting purposes in an urban district or in a populous place. The Board's practice is only to give consent for five years, and this condition the company refused to accept; ultimately the Board refused to sanction the proposed overhead system.

We must confess to a certain amount of difficulty in reconciling this exposition of the—to put it mildly—semi-hostile attitude of the Board, with the sympathetic utterances which that department's officials are wont to make unofficially.

It is usual on such occasions to assure the doubting ones that "applications for consent for overhead wires are considered in each case on its merits"—an ambiguous statement of policy which experience has shown, carries no obligation to take other than a grandmotherly view of things.

Farnham, for instance, cannot be regarded as a "populous" or urban centre, but it may legitimately be considered as a suburban district, where a saving of, say, 60 per cent. in the outlay on distribution plant would make all the difference between success and failure in an electric lighting scheme. Then, again, we cannot conceive of any traffic in Farnham, comparable with that which passes under hundreds of miles of bare trolley wires in Manchester, Glasgow, Liverpool, Birmingham, &c., without causing annoyance, and with complete immunity from damage.

However good may be the intentions of the Board, even its strongest supporters cannot but admit that the official handicap rarely gives overhead distribution a winning chance in the race.

But if the Board of Trade is sometimes inconsistent, it can also on occasion be humorous. Take the case of Colchester, which recently proposed to give an additional supply to the Hythe district. An underground feeder for this purpose would have cost some £2,500, and as this was out of the question, it was proposed to run an overhead feeder, supported on the tramway poles, at a cost of £675. This involved an application to the Board, which, in its wisdom, decided that as the overhead feeder would be of large size, of a permanent nature, and the route of an urban character, it could not give its consent. In consequence of this the borough electrical engineer arranged to utilise the trolley wires along the same route as feeders.

This arrangement has, of course, certain practical disabilities which are not calculated to impress would-be consumers; it is a makeshift at the best, but it happened to be the cheapest method in the case in point; moreover, the Board of Trade apparently does not object to it, as no application is necessary to that body for permission. This is the curious feature; two bare 500-volt trolley wires,

necessarily running over the public highway, for supplying tramway motors, car lighting, &c., and subjected to the shocks and jars of tramway working, cannot, even by a stretch of the Board's vivid imagination, be regarded as dangerous in view of past experience, but a third bare or possibly braided wire following the same route, working presumably at about the same pressure, and under the best possible conditions, for supplying stationary motors and lighting, is open to objection because "it is of large size" (and presumably stronger than trolley wire), of a permanent character (like the trolley wire), and follows an urban route (like the trolley wire).

One cannot help picturing this Pooh Bah-like department solemnly addressing the Colchester authorities on the right hand, with: "No, you cannot have a bare feeder wire over a public street; impossible! Never heard of such a thing; would be most dangerous, and besides it would establish a precedent, which would be more serious than an accident." Then smilingly addressing the Colchester authorities on the left, with "Oh, certainly, you can use a bare trolley wire in a public street; dangerous? never heard of such a thing, thousands of miles of bare trolley wires over our most populous thoroughfares; scarcely hear of trouble with them. What! trolley wire becomes a feeder? Absurd! A trolley wire supplying stationary motors and lighting is *a trolley wire*, but an overhead wire attached to the same standards, and doing the same thing is *a feeder*—a very different thing. Any fool ought to know that."

Unfortunately, such quaint methods do not lend themselves to progress in these seriously commercial times; for the days when the central station engineer could, also Pooh Bah-like, turn to his latest client, and say "Another little insult" have passed.

Meanwhile, thousands of would-be electricity consumers are within reach, if only the commercially sound system of dealing with them cheaply, in the first instance, can be adopted.

REVIEWS.

Power Railway Signalling. By H. Rayner Wilson. London: *Railway Engineer*. Price 18s. net.

No more convincing proof of the important place now occupied by railway signalling can be afforded than is given by the publication of this book, which, admittedly, deals only with a portion of the subject. It is a great book—in more than one sense—and forms a monument to the industry of the author and his intimate acquaintance with his subject.

It is difficult adequately to review the contents of the 23 chapters of the book, owing to the mass of material to be considered, and the fact that the apparatus dealt with in each chapter are specialities, and each would almost serve for a review such as this. The utmost that can be done with a book like this is to treat it generally, and taste—as it were—the contents here and there.

The phases of signalling are many, but in this book the constructive or engineering side is most prominent, and we find the bulk of the work devoted to descriptions and illustrations of the apparatus used under what may be termed the various stages of progress. In Chapter I attention is mainly directed to the signalling apparatus necessary for marshalling traffic in the order of its importance, notifying its progress, and providing for its safety, *i.e.*, the signalling apparatus usually comprised under the term "block telegraph system."

In the immediately succeeding chapters, apparatus for remedying the known defects of manually operated and controlled systems—lock and block—are discussed. In a later chapter particulars are given of auxiliary apparatus by which control is made more effective.

These are followed by reference to special conditions, such as the interlocking of swing-bridges, after which the requirements of single lines are dealt with, and tablet and train staff instruments fully described. Sections on automatic signalling for ordinary steam railways, electric railways and electric tramways follow in order, and there is a short chapter on locomotive cab signalling and train control.

It is at this point, more than halfway through the book, that we come to descriptions and illustrations of apparatus more generally included under the head of "Power Signalling." Here we find voluminous details of electro-pneumatic, low-pressure pneumatic, all-electric, electro-mechanical and hydraulic power plants. As will be evident from this bare recital, the plan of the book is progressive and its scope comprehensive.

The important subject of automatic signalling is dealt with in seven chapters, which contain not less than 145 illustrations, many of which are of a most elaborate character. In his prefatory remarks on the applications of automatic signalling, the author traces the reasons for its adoption in the United States, and compares the conditions obtaining in this country. The conclusion come to is that "In Great Britain the greatest use of automatic signalling on ordinary steam railways will be found in dividing long block-sections, and as an alternative to, and a substitute for, intermediate block posts." In an estimate for the equipment of 20 miles of double line, the author finds that in order to justify automatic signalling, it would be necessary to displace 33 signalmen, each costing the railway company £60 per annum. It is difficult to follow the author's reasoning in this estimate, as he has equated the whole annual cost of the automatically-signalled road with the signalmen's wages. But even a manually-operated signalling system requires semaphore signals, operating frames, block signalling instruments, &c., which, if taken into account, would materially alter the estimate.

Among other reasons why automatic signalling has not made much headway in this country and on the Continent the author recognises that signalmen perform other useful functions than those connected with the ordinary signalling of trains. A study of the block code and the regulations laid down in connection with it, shows other protective functions that the signalman has to perform for which automatic systems provide no alternative.

This section of the book is, perhaps, the most interesting of any for those considering the possibilities of electricity in connection with automatic operation, but considerations of space prevent detailed reference to the apparatus described. It is to be regretted that the author has not amplified the information given on that new development, cab-signalling. It is a subject which has rapidly come to the front recently, and which has been constantly advocated in these pages for many years.

The last six chapters of this book deal with the apparatus to which the name "power plant" is most usually given.

In the author's view, the reduction of physical labour does not result in any saving of the time of operation, owing to the hiatus in the sequence of operations rendered necessary by the "Return Indication." The author is also doubtful whether power plants effect an actual reduction in the number of men required. "It is the traffic movements, and not the amount of work, that is the governing factor," he remarks. But the amount of work depends upon the traffic movements, and, in many cases, the signalman's remuneration is fixed by the number of movements he is called upon to make by the traffic he controls.

There are many points in connection with the author's summaries that are questions of opinion with which we cannot altogether agree, but space will not allow of their being discussed here. We cannot agree with the general statement that all-electric systems "call for a greater consumption of power . . . ." If one thing is more striking than another in all-electric systems, it is the small power demand and small consumption of electrical energy. In one case known to us, the total consumption at a cabin containing over 130 levers, during 1907, was 3,670 units, or about ·09 unit per lever per day, and the cost was less than £17 at the price per unit charged. Even this small amount considerably exceeded the useful consumption, for certain reasons connected with the equipment which it is unnecessary to specify.

In conclusion, we may say that the thanks of all in any way connected with, or interested in, railway signalling are due to the author for this book. It is a standard book of reference in which the author has held the scales impartially,

and which constitutes a mine of information. To electrical engineers it is especially interesting and instructive on applications of electricity to purposes with which they seldom are brought into intimate contact, but which constitute a field of application of which the boundaries are ever widening. It constitutes an epitome of present-day practice, and a study of its diagrams is a revelation in the manipulation of circuits equal, in its educational effects, to the Post Office diagram book.

Drahtlose Telephonie. By Ernst Ruhmer. Berlin: 1907. Published by the author.

Wireless Telephony. By Ernst Ruhmer. Translated by J. Erskine-Murray, D.Sc. London: Crosby Lockwood and Son. Price 10s. 6d.

The German treatise is a work of some 150 pages closely figured with 189 illustrations, and constitutes a useful compendium on the subject. The reliability of the information contained is vouched for by the fact that Ernst Ruhmer is himself a well-known and careful experimentalist in several diverse fields of research in wireless telephony. The book is therefore to be welcomed as a useful and concise account of work done in a subject rapidly advancing towards practical and commercial realisation.

In the English translation by Dr. Erskine-Murray due justice is done to the author's method of exposition, which is closely followed throughout. An appendix has, however, been added by the translator, which deals with the most recent advances unfolded, and with the history and position of the subject in the United States, especially so far as the claims of Prof. Fessenden are concerned. The practical details of the apparatus used, and actual results of tests of the latter's system, are explained and illustrated at some length. If the claims made by Prof. Fessenden can be substantiated and confirmed, there is no doubt that they demand high appreciation. In the original German no very full treatment is accorded to his reputed achievements, hence the appendix forms a useful supplement. In the first few chapters the earlier attempts in the direction of wireless telephony, covering the photophonic, speaking arc and conduction methods are fully discussed. In treating of the conduction methods, however, the author appears to have lost sight of one of the most serious factors concerned in determining a limit both to the range of operation and to the practical utility of the method—viz., the insuperable disturbances caused by erratic and variable earth currents, which come into play with increasing force as the length of the base lines is increased, and which cause disconcerting noises in the telephone receiver even where relatively short base lines and small ranges are concerned.

"Spark telephony," or telephony by short successive trains of waves, is broached in Chapter IX, and the various aspects and limitations of high-frequency sparking, with the object of adapting it to wireless telephony, receive due notice. It is pointed out, however, that the prospect of achieving good practical results with any system depending on discontinuous radiation is, as might be expected, well-nigh hopeless on account of the apparently insuperable difficulties of eliminating irregularities and maintaining effective oscillatory sparking at rates sufficiently high to serve the purpose of telephony.

It is not until Chapter XII that the only methods of any real promise are touched upon—viz., those depending on the generation of continuous and uniform electric oscillations. Such oscillations are often but somewhat incorrectly called undamped oscillations. They are rather of the nature of damped oscillations where the effect on the wave amplitude due to damping is balanced out by continuous inflow of energy to the system. The various arc systems for the generation of sustained high-frequency oscillations are touched upon, but the real practical difficulties encountered in applying the method to wireless telephony receive somewhat scant attention. That may, however, be reserved for the future, as there is certainly much to investigate and perfect before wireless telephony reaches the stage of commercial realisation, though there may not be much doubt that it is within grasp.

The book may be recommended to any who may be scientifically interested in the history and trend of development of this promising field of research.

Questions and Solutions in Telegraphy and Telephony. By H. P. Few. Printed by W. Holmes, Ulverston. Price 2s.

The season for the City and Guilds Examinations in these subjects is now drawing very near, and there is no doubt that many teachers and students who are engaged in brushing up and rendering suitable for presentation at the examinations the knowledge imparted and gained during the session will welcome the appearance of this little manual, which, without aiming at anything in the nature of literary pretensions, gives, in very concise and valuable form, answers to many of the questions set in the examinations from 1904 to 1908. The little volume is of such size as to be carried in the pocket readily, and therefore it will be of special value to those who desire to avail themselves of odd moments to refresh their memories or to settle a doubtful point upon which they are cogitating, and it also gives the answers to the questions in a model form, so as to be a most useful guide to many who, although they may be able to answer the questions quite correctly, perhaps do not appreciate the need there exists for couching their answers in such form as to be acceptable to the examiner. This feature in the book is no doubt due to the experience in passing examinations obtained by the author himself; for we observe that he is a silver medallist and first-class honoursman in similar examinations. Apart from the utility of the book in the direction indicated above, it is valuable to the general run of persons who are interested in the subjects named, as containing in condensed form much useful information.

We notice, however, several minor inaccuracies in the text which might be held to impair the value of the publication, particularly as regards the latter qualification referred to above. For example, we observe that the reply to the question:—"How may the electromotive force of a battery be increased?"—states that the E.M.F. depends solely upon the materials of the plates, and goes on to say that the maximum E.M.F. is obtained when the cells are joined in series. This is quite right in the main, but is hardly the answer to the question, to which we would be inclined to reply *by adding more cells in series*, as a more practical answer. Then again, the question is "Describe a paper-insulated air-space cable and explain its advantages for telephone purposes over other descriptions of insulated wires." The author describes a composite telegraph and telephone cable having screened wires as part of the number of conductors, an answer which is surely more than any examiner would require. Also, in discussing the speaking efficiency of telephone circuits, the author refers to the *shifting* of the harmonics, which is hardly scientifically correct. There are a few other details of this type to which it is not necessary for us to call attention, but which, no doubt, the author will rectify before the book runs to its next edition, to which it is certainly entitled. And here we are inclined to digress slightly to express a sense of wonder that so many of the technical works that we are called upon to review always await the second edition to correct inaccurate details, which surely should be detected by careful proof reading, and remedied before the first is published. However, we can commend the present little work, and are pleased to welcome the author, who makes his first appearance in the ranks—albeit somewhat crowded—of authors of technical literature.—R. M. H.

The Proper Distribution of Expense Burden. By A. Hamilton Church. London: The *Engineering Magazine.*

It is becoming increasingly important from year to year to obtain the true cost of producing all kinds of machinery and appliances, and in no line of manufacture is this subject of greater moment than in the production of electrical apparatus. Some years ago a series of articles by Mr. Church appeared in the *Engineering Magazine*, in which he put forward a new method of reckoning up shop and establishment charges—such as power, supervision, rent, office expenses, &c.—which cannot be directly debited to the jobs in hand. The work under review consists of a reprint of these articles bound up in book form.

The earlier chapters are devoted to proving the need for some method of accurately obtaining the indirect expenditure on each job, and the incorrectness of the systems at present in use. The plan of adding these charges as a percentage on labour is discussed at some length, and it is contended that the charges for space, interest, depreciation, power, &c., for a large machine tool are the same as for a small one under this system, excepting for any difference in the rate of wages paid to the operators; further, that when a high-priced man is replaced by one at a lower rating, the total for labour, and hence for indirect charges, may be the same in either case, although the cheaper man has taken longer over the job, and consequently incurred a higher indirect expenditure, as the latter is based mainly upon time, other conditions being equal.

The author's system is explained by imagining each machine tool, fitter's bench, &c., to be enclosed and let to an independent workman at a rent which covers all expenses, such as capital charges, lighting, repairs, building space, &c., whilst a separate charge is made for power according to the demand. By cutting out the partitions and charging this rent in the form of an hourly rate, we get a method of computing indirect charges which is theoretically correct.

In fixing this hourly rate, the average power must be included, and the machines are assumed to be working on full time (48 to 54 hours a week). If a machine shop were worked at its highest efficiency, the total from these rates would equal the total of the shop charges as found from the various accounts. In actual practice, the total rates are always less than this figure, and the difference forms a useful indication of the way the work is being put through the shops.

According to the author's system, establishment charges such as office expenses, advertising, selling, &c., are kept distinct from the indirect expenditure on the actual manufacture, and he propounds a method of adding these charges which is obviously more accurate than the plan of distributing them as a percentage on labour, this being done without entailing any lengthy or complicated process. Many difficulties likely to arise in establishing his system are considered by the author, and every possible contingency appears to be allowed for.

Those responsible for the organisation of new undertakings should carefully consider Mr. Church's system, as the fixing of the rates is comparatively easy in new concerns. In an old undertaking, the work entailed in adopting this method is a very serious item, and may necessitate the retention of an expert in this line. Once the rates are fixed, however, a revision every two or three years is a simple matter, and we understand that several old-established firms have taken up this system, the results being satisfactory wherever it has been adopted.

Mineral Waxes; Their Preparation and Uses. By Rudolf Gregorius; translated from the German by Chas. Salter. London: Scott, Greenwood & Sons. Price 6s. net.

In its most narrow and modern meaning the term "Mineral Wax" (German *montan*) is understood to denote the product obtained from lignite tar, principally in Thuringia. Happily the author has not confined his work to this substance, but has included the consideration of all the mineral waxes proper of the type of ozokerite and its product ceresine, and also of that most important article paraffin. Dr. Gregorius rightly points out that, although the preparation of paraffin, ceresine and "montan" wax ranks among the great industries, the general knowledge regarding these substances compared with other industrial products is small, probably because the industry, as a branch of manufacture on a large scale, dates only from the seventies of the last century. The work will for this, if for no other reason, be welcome to the general reader, and particularly to the specialist in other industries who may require readily accessible information concerning any of the waxes referred to. This is frequently likely to be the case, as may be readily gathered from the chapter on "Uses of Ceresine, Paraffin and Mineral Waxes." In this chapter the electrical reader will find much of interest in the paragraphs on wax for insulating electric cables, paraffin wrapping paper, electrotype wax, electrical insulating compositions and gutta-percha substitute, and further in the description of and recipes for paints and preservative compositions for metals and other materials, &c.

In the first chapter Dr. Gregorius deals with the origin occurrence, manufacture, purification and properties of ozokerite and its derivative ceresine, and also with the adulteration and testing of the latter and of beeswax. The most common adulterant of ceresine is paraffin, and similarly both these substances appear to be used for cheapening beeswax. In Chapters II and III, the derivation, composition, properties and manufacture of paraffin from various sources (shale oil—Russian and American petroleum—peat and lignite tars, &c.), and of mineral (montan) wax are discussed, and Chapter IV is devoted to various appliances for extracting, distilling, and refining the different products.

The illustrations are mainly of a practical nature, and the work is neatly printed and bound. We may add that the work of translation appears to have been carried out excellently.

The Companies' (Consolidation) Act, 1908, with a general survey of earlier enactments, notes on the Act, and a comparative table of the old and new Acts. By Frank Evans and Humphrey H. King, B.A., LL.B., barristers-at-law. London: Butterworth & Co.

Complaint is often made that the laws of England are uncodified; that he who would essay to find the law on any particular subject must not only consult one statute book, but many portly tomes; and that even the statutes themselves are unsafe to rely upon unless regard is had to the most recent decisions of the Courts. Realising the inconvenience of a scattered system of jurisprudence, the Legislature has made divers attempts to codify the law upon certain great subjects; the work now before us is a commentary upon an Act of 1908, which codifies the law relating to joint stock companies.

While not pretending to be in any sense a treatise on the vast subject of English Company Law, or even a comprehensive survey of its leading features, the work of Messrs. Evans & King yet serves a useful purpose by enabling practising lawyers and others, for whose profit or protection such knowledge is necessary, to gain a comprehensive view of the effect of the new Act, and by guiding them through its nearly 300 sections. The first part of the work contains a short survey of company legislation. The Consolidating Act, 1908, is set out at length in Part II, notes being appended to indicate the origin and apparent purpose and effect of the various provisions. The Consolidation Act came into operation on April 1st, 1909, and in the main it is, as it purports to be, a mere consolidation of previous enactments. The language of the previous Acts has, however, not been strictly adhered to, but the alterations are for the most part such as are inevitable in the process of consolidation, or are rendered necessary for the removal of ambiguities or inconsistencies.

A most important feature of the work is to be found at the end, where there is a table giving references to the various sections and sub-sections of the old Companies' Acts, together with the corresponding section of the new Act. Many a director, secretary or lawyer will remember the section of the old Act; and he will want to know where he is according to the new measure. We heartily commend this little work to those of the public who are interested in public companies.

Direct-Current Electrical Engineering. By James R. Barr. London: Whittaker & Co. 1908. Price 10s. net.

The volume under notice is of about 550 pp. with 294 illustrations, and "has been written primarily for the intermediate class-work of universities and technical colleges, the basis being a series of the author's lectures to second-year students, with a selection of problems systematically arranged in the order of treatment of the subject."

The author's reason for writing this book is the familiar one, that he "realised the want in recent years of a really suitable text-book." The reviewer during his teaching experience has found the same "want," but this is probably due more to the fact that each teacher has his own particular likes and dislikes, and approaches the subject in his own special manner, than because of the unsuitability of the existing text-books. Hence not until that Utopian period when we shall all have one language and one tongue and one thought shall the prospective author of an electrical engineering text-book be deprived of his "really suitable" excuse.

In saying this, however, we find no fault with the present author in his endeavour to reach his ideal, and consider that he has made a very creditable attempt to put the principles of direct-current electrical engineering into a form suitable for students of the subject. We must also award him his meed of praise for eliminating almost entirely the catalogue illustration, which has been too long a feature of many text-books.

Chapters I and II are devoted to units and fundamental principles, and as the book is intended for students who have had a previous elementary training, these subjects are dismissed inside of 30 pages. In many of the definitions there is a certain laxity of expression which the author might rectify in a future edition. On p. 26 the author denotes electrochemical equivalent by "e" and gives the equation for the weight of an element liberated as $w = e\,c\,t$. The older and better known form, $w = c\,t\,z$, seems much preferable, especially as there is no apparent reason for departing from it. Apart from this, "e" is very often used to denote "Back E.M.F," or the instantaneous value of E.M.F., and the author uses it in this connection on p. 237 when dealing with the principles of the dynamo.

Chapter III deals with electromagnetism and magnetisation of iron, and descriptions are given of methods of, and instruments for, testing magnetic permeability and hysteresis.

The following chapter deals with electrical measuring instruments in a very clear and satisfactory manner, all the various types of ammeters and voltmeters being illustrated and described. Electricity supply meters are also treated in the same chapter in a very succinct manner, although the author might with advantage have devoted more space to such important adjuncts of an electricity supply.

In Chapter V the storage battery is dealt with in theory, design, construction and installation, and is disposed of inside 24 pages; this is quite inadequate for such a subject.

Electric lighting receives attention in the succeeding chapter, starting with incandescent lamps. On page 150 there is given a polar curve with the corresponding Rousseau diagram, and in the description on the following page, G J H is used twice, instead of G K H. Carbon and metallic lamps are described, but we notice that the "osmium" lamp is spoken of; this might easily have been replaced by a note on the tungsten lamp before the book went to press. Then follow descriptions of the Nernst and various forms of arc lamps, and the section concludes with a few pages dealing with illumination and photometry. One or two points in this chapter may be noted; page 152, "acclusion" should read *occlusion*; page 187, "when four or more arcs are connected in series, no steadying resistance is necessary"—what does the station engineer say to that? page 189, "candle-foot" is now more generally written foot-candle; "Altenck" should be Alteneck.

Chapter VII is given over to the discussion of underground and aerial conductors, particulars being given of the various ways of laying the former, and of erecting pole lines for the latter. Here under insulation testing appears a very good description of Evershed's Megger; this would have been more appropriately included in the section on instruments, with a simple cross reference. In fig. 124, "moving system of Evershed's ohmmeter," coil marked C should be D instead.

In Chapter VIII the author enters on a very full treatment of the dynamo, which is continued through the two following chapters. The armature, commutator and brush gear are first dealt with, and coloured inks are used to differentiate the various circuits in armature windings and field connections, &c. Chapters IX and X treat of the design and calculation of the magnetic circuit, armature reaction, the characteristic curves of dynamos, and boosters.

Motors, starters and controllers form the subject matter of Chapter XI, and are well treated and fully illustrated by diagrams. The heating losses, efficiency and testing of direct-current machines are considered in the following chapter, and the last chapter is given over to details of electricity control.

On the whole, this is a very satisfactory text-book. There are certainly points where it might be improved—where the treatment has been a trifle snippety—but that only emphasises the fact that even direct-current electrical engineering is too large a subject to be effectively dealt with inside the compass of an ordinary text-book. Therefore, while complimenting the author on his production, we are afraid that the "really suitable" text-book is still to seek. —J. D. M.

The Elementary Theory of Direct-Current Dynamo-Electric Machinery. By C. E. Ashford, M.A., and E. W. E. Kempson, B.A. Cambridge University Press, 1908. Price 3s. net.

On opening a book of 120 pages, crown 8vo, purporting to give the theory (even if qualified by the term elementary) of the direct-current dynamo, one is liable to feel a trifle disappointed. That was certainly the feeling we had on lifting the volume under notice. However, disabusing our mind of preconceived notions as to the proper treatment of the subject and reading the book carefully, our opinion suffered considerable modification.

In the preface the authors state some obvious truisms which are as obviously ignored by many writers, and as the methods adopted in this volume are somewhat novel, it seems advisable to give an extended extract from it.

"The authors . . . . believe that in the training of an electrical engineer there should be included a knowledge of the subject *built up logically from first principles*, each step being illustrated with the help of some piece of machinery or practical appliance of a general and simple rather than an elaborate or necessarily up-to-date type; and that he should be taught not to accept statements without evidence of their truth. If he follows this plan he will be *able to understand any piece of electrical machinery* which he comes across, not because he has ever seen or heard of it before, but because he can recognise it as a *particular case* of a *general class* whose *fundamental principles he has mastered*. If, on the other hand, he attempts to learn one by one all the various commercial machines and appliances on the market at the moment, his task will be unending. The creation of new types is unceasing, but *the principles are permanent*. The present book does not cover much ground, but the authors have attempted to present as logical a treatment as is possible in so elementary a work. It is, of course, intended to be used only as a notebook accompanying a course of experimental lectures. . . ." The italics are ours, and with the foregoing remarks we are in full agreement.

The book is divided into nine chapters with 58 numbered paragraphs, an appendix, and a series of examples with answers. The index rightly gives page and not paragraph number.

"Relations between Electric Currents and Magnetic Fields" is the subject matter of the first chapter, and is treated in three sections headed, respectively, Magnetic effect of a current of electricity, Magnetisation of iron and steel, and Force on a current-bearing conductor in a magnetic field. In dealing with the magnetisation of iron and steel, a rough magnetometer method for obtaining the magnetisation curves and the hysteresis loop is shown and described. We think that it would have been much better to *reverse* the current in this experiment than to "commutate" it.

Chapter II gives us the "essential parts of dynamo-electric machines," and the mechanism of a suspended coil galvanometer is illustrated and used to give the first notion of an electric motor. Armatures, field magnets and the induction of electric currents and their direction are then touched upon, while in par. 10 a first notion of a dynamo is given. The succeeding paragraph dealing with

the dual aspect of dynamo or motor is particularly lucid. On page 17 first and second lines appears this phrase: "the current . . . . varies inversely as the resistance . . . . as well as directly as the electromotive force." Simple as — ?

In the following chapter the behaviour of practical forms of machines is dealt with, and the principles of field magnet windings and starting switches are outlined, fuller treatment being given to these points further on.

Energy losses and efficiency form the next section, and are carefully studied in Chapter IV, the various points being well illustrated by diagrams. Dealing with slotted armatures and their effect in causing eddy currents in the pole-pieces, the authors say on page 37, "it becomes necessary to laminate the pole-pieces." It is certainly advisable, but is not *necessary* rather strong a word to use? Again, on page 40, *et seq.*, we find "D.P." used for potential difference instead of the more usual form, P.D.

Chapter V leads up from the quantitative meaning of magnetic lines of force to a consideration of the E.M.F. generated in a conductor cutting lines of force, and the next chaper is devoted to tracing out the logical development of armatures (shuttle, ring and drum); the concluding paragraph giving the formula for E.M.F. generated in a dynamo.

The authors then deal in Chapter VII with the characteristics of motors and dynamos, including characteristic curves and the behaviour of motors under different conditions. Expressions are found interconnecting the torque, mechanical-power, speed and magnetic flux, the general formulæ being worked out for a separately-excited machine and then applied to the particular instances.

Chapters VIII and IX deal respectively with the production and measurement of a magnetic field and reactions in the armature. In the former the authors treat of magnetic flux and its dependence on the magneto-motive force, permeability and reluctance, hysteresis, energy loss in magnetisation and the molecular theory of magnetisation. They here, in fact, invert the usual order of teaching the subject by placing this portion of theory at the end of the book, instead of at the beginning as is the usual practice. The section on Armature Reactions is very clearly worked out, the authors treating concisely of the armature demagnetising and cross-magnetising effects, self-induction and sparking. By the time we had read through thus far, we were quite interested in the authors' methods, and on reading this sentence at the foot of p. 107—"Now the reaction of the armature on the field magnets tends to weaken the field near the hindward pole horn, and under certain circumstances it becomes necessary to introduce compensating coils to prevent this reaction, otherwise the sparking may be excessive"—we turned over the page to learn how the authors managed it, only to find an Appendix on the Use of Magnetic Circuits! It was tantalising; did the authors lose a proof sheet, or did they forget to add the footnote "Will be continued in our next issue"?

The book is well printed and fully illustrated by 72 diagrams, and there seem to be no printers' errors. It ought to be most valuable to junior students, and would form a very efficient basis for a course of lectures to evening-class students especially.—J.D.M.

Rail-Joint Testing Car.—Our Berlin correspondent sends us particulars of a car designed by the Austrian Siemens-Schuckert Co., at the instance of the manager of the Vienna municipal tramway, to test the condition of the rail joints. The car carries contact brushes, which can be applied to the rails, and the rims of the four wheels are insulated and provided with slip rings, so that a heavy current can be sent through the length of rail between the front and rear wheels on either side of the car at pleasure, while the potential drop through the section of rail in question, which may or may not include a joint, is read off by means of a voltmeter reading to 1·5 volts, connected to the contact brushes. The testing current—about 200 amperes—is provided by a motor-generator carried on the car, and fed from the trolley wire. The car itself is hauled by a motor-car or horses, and can be used for testing whilst in motion, any bad joint being at once indicated on the voltmeter. Under fair conditions 2 or 3 km. of rail can be tested per hour, so that in the course of four hours' cessation of traffic during the night the car can traverse and test four or five miles of track.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

CAPE VERDE ISLANDS.—The Customs declaration for imported goods must indicate the name and nationality of the vessel and the port whence proceeding, the name of the master, the date of entry of the vessel, the origin of the goods, the marks, number and gross weight of the packages; the denomination of the goods contained in each package; the net weight (detailed) of each kind of goods, or the number of the articles, if they be dutiable, according to quantity; and the value (detailed). *Ad valorem* duties are levied on the value of the goods at the place of origin or manufacture, increased by the expenses for freight, insurance and commission incurred up to their arrival in the Custom House for clearance. Duty is levied on the net weight of the goods; this weight is ascertained, in the case of the undermentioned goods, by deducting the following tare allowances:—Barrels, casks and cases, 12 per cent.; baskets, dossers, crates, tins, &c., 6 per cent.; sacks and bales, 2 per cent.; packages with wrappers (in addition to the stipulated tare), 2 per cent. The interested parties may, however, claim to pay duty on the actual net weight, ascertained by weighing the goods without packings.

1,000 reis = 4s. 6d. Kilog. = 2·204 lb.

The following duties are payable:—	Reis per kg.
Tar, pitch and coal tar	20
Caoutchouc manufactures not separately specified ...	500
Cement	1
Copper or brass, cast, hammered or rolled	10
" " wire and pipes	100
" " in manufactures not separately specified	500
Iron or steel, cast, hammered or rolled (in bars, hoops, angle and T-iron, in wire or in plain or corrugated sheets, whether coated or not with zinc, copper or tin)	3
Iron or steel intended for building purposes ...	25
Cast-iron and steel wares not otherwise specified ...	60
Small articles of iron or steel for use in building, tools and utensils and all other articles of hammered or rolled iron	100
Earthenware pipes	10
Stoneware pipes	30
Common black or green glassware (except bottles)	30
Glassware not otherwise mentioned	150
Industrial machines and instruments	Free.
Other electrical and similar goods	20% ad val.

Naval Reserve of Electricians.—The Admiralty, in order to form a reserve of operators in wireless telegraphy, has decided to allow telegraphists to enroll themselves on condition that they have completed their first continuous engagement, and, after having joined, they will be required to continue in their trade of wireless telegraphy in civil life, their retention in the reserve being conditional on their being able to pass a test examination at the conclusion of their periodical training at their various ports. In order that their chances of obtaining civil employment after leaving the service may be improved, men who are within one year of completing their engagements will be allowed to present themselves for examination by the Post Office authorities, in order to be granted a certificate in commercial wireless telegraphy, without payment of the usual fee. The method of receiving at sea is by telephone, and requires some little practice, even for a telegraphist who is thoroughly competent to take in Morse signals either by eye or the Morse sounder. The Admiralty might do well to consider the suitability of other skilled branches for enrolment in the Naval Reserve. Now that the electrical equipment of modern warships is of so varied and extensive a nature, the necessity for expert electrical reserves is becoming a serious consideration. The whole armament is becoming more and more dependent on electricity as a means of transmitting power and facilitating communication. The complicated wiring, concentrated as far as possible behind armour and below the water-line, calls for more than elementary knowledge in its maintenance. Upon the rapid localisation of a fault or the detection of an undeveloped one much may depend. In a fully-commissioned ship the electrical staff is at present none too large, and in war-time these men, who are trained to fight, may be called on deck to supply the deficiencies of guns' crews. It requires little training to assist at supplying ammunition, which is the work that supernumeraries would be called on to do when not actually employed at their trade, and it is in the ammunition passages that most of the vital portions of the circuits are placed and that communication with all parts of the ship is maintained, so that it would be easy to call out such of the electrical party as were needed to execute distant repairs in other parts of the ship as they might be required. Modern ships' fittings are arranged on very similar lines generally, and a short period of training given to such reserve electrical ratings from time to time would give them sufficient insight into the duties required of them to form an efficient reserve in time of need.

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

6,764. "Improvements in or connected with devices for making and breaking electric contacts." F. H. Varley. March 22nd.

6,770. "Tabulator accumulator." H. W. Twaites. March 22nd.

6,773. "Improvements relating to storage batteries." W. Fennell and W. P. Perry. March 22nd.

6,777. "New or improved device for heating ovens, radiators, cooking utensils, hot plates, irons and the like by means of electricity." C. F. Parkinson. March 22nd.

6,809. "Improvements in the steel armouring ectrical caoles E. A. Claremont and J. Stratton. March 22nd

6,818. "Electric street car ndicator." H. E. Fisher. March 22nd. (Complete.)

6,820. "Improvements in electric furnaces." J. H. Reid. (Date applied for under Sec. 91 of the Act, August 22nd, 1908, being date of application in United States.) March 22nd. (Complete.)

6,832. "Improvements in electric snap switches." H. W. Lake. (Cutler-Hammer Manufacturing Co., United States.) March 22nd. (Complete.)

6,836. "Improvements in electric light reflectors for concentrating light." G. F. Allom. March 22nd.

6,843. "Improvements in incandescent electric lamps." J. Auerbach. (Date applied for under Sec. 91 of the Act, January 23rd, 1909, being date of application in United States.) March 22nd. (Complete.)

6,849. "Improvements in solenoid brakes for electrically-driven carriages." G. Rizzo. March 22nd.

6,850. "Improvements in friction couplings adapted for use with electro-motors for driving machine tools and the like," P. M. Justice. (La Société Anonyme Electricite Electromecanique, Belgium.) March 22nd. (Complete.)

6,872. "Improvements in and relating to electrolytic cells." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 22nd.

6,877. "Improvements in hand-operated magneto-electric machines." Siemens Bros. & Co., Ltd., C. R. Riber and H. W. F. Ireland. March 22nd. (Complete.)

6,878. "Improvements in telephone installations." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) March 22nd. (Complete.)

6,883. "Improvements in long-distance control apparatus." M. Cagliani. March 22nd.

6,888. "Improved method of signalling by electrical apparatus between a fixed position and a train in motion." G. T. Simmons. March 23rd.

6,902. "Improvements in the arrangement and combination of electric with steam and internal combustion engine for ship propulsion." F. Foster. March 23rd.

6,916. "Improvements connected with the generation, storage and use of electric power, particularly for lighting purposes." C. B. Walker. March 23rd.

6,936. "Improvements in processes for manufacturing metal-filaments for incandescent electric lamps." Westinghouse Metal-Filament Lamp Co., Ltd. (A. Lederer, Austria.) March 23rd.

6,939. "Electro-magnetic relays and the like." O. D. Lucas. March 23rd.

6,940. "Automatic switching apparatus for the control of direct-current motor-generators and the like." O. D. Lucas. March 23rd.

6,945. "Improvements in expanded metal for electric accumulators, electrodes and other purposes." J. T. Szek. March 23rd.

6,948. "Improvements in and relating to induction electric motors." Siemens Bros. Dynamo Works, Ltd., M. Kloss and K. W. Schaeffer. March 23rd.

6,949. "Improvements in and relating to dynamo-electric machines for operating search-lights and the like." Siemens Bros. Dynamo Works, Ltd., and M. Kloss. March 23rd. (Complete.)

6,956. "Improvements in and relating to the starting and regulating of electric induction alternate-current motors." Siemens Bros. Dynamo Works Co., Ltd., and M. Kloss. March 23rd.

6,957. "Improvements in or relating to starting devices for alternating and three-phase current motors." M. Kallmann. (Date applied for under Sec. 91 of the Act, March 28th, 1908, being date of application in Germany.) March 23rd. (Complete.)

6,962. "Improvements in induction coils." A. W. Sharman. (Date applied for under Rule 18, June 4th, 1908; an invention comprised in Application No. 1,214, dated June 4th, 1908.) March 23rd. (Complete.)

6,974. "Improvements in short-distance telegraphic apparatus." R. A. Webb. March 23rd.

6,985. "Improvements in and relating to signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 23rd. (Complete.)

7,005. "Improvements in and relating to electric prepayment meter mechanism and the like embracing a warning or alarm switch." J. H. Bowden, J. A. Robinson and A. H. Jacks. March 23rd.

7,012. "Improvements in or relating to the sockets or holders of incandescent-filament lamps and to other similar electrical devices." J. A. Kennedy-McGregor. March 24th.

7,017. "Improvements relating to supporting metallic filaments." F. Harrison and J. G. Pickering. March 23rd.

7,029. "Improved appliances for cooking and heating by electricity," N. Hosgood. March 24th.

7,047. "Improvements in or relating to prepayment mechanism in connection with renting or hire purchase of electric installations or standing charges in connection with a fixed contract price for current." F. H. Merritt. March 24th.

7,048. "Improvements in telemotor gear." J. Mackintosh. March 24th.

7,053. "Improved slow-motion device for operating switches." F. J. Moffett and N. B. Rosher. March 24th.

7,058. "Improvements in constant voltage dynamos for electric lighting and charging." O. M. Shepherd. March 24th.

7,060. "Improvements in rotary electric transformers and motor-generators." Crompton & Co., Ltd., J. C. Macfarlane and H. Burge. March 24th.

7,073. "Improvements in or relating to electric lamps." E. Frenot. (Date applied for under Sec. 91 of the Act, June 1st, 1908, being date of application in France.) March 24th. (Complete.)

7,081. "Improvements in telephone attachments." H. F. Hansell, junr. (Date applied for under Sec. 91 of the Act, February 4th, 1909, being date of application in United States.) March 24th. (Complete.)

7,092. "Process for the manufacture of non-carbon incandescent filaments from refractory metals or their compounds." W. Heinrich. March 24th. (Complete.)

7,097. "Improvements in bifunctional storage battery plates." A. O. Tate. March 24th. (Complete.)

7,106. "Improvements in synchronous alternating-current machines with automatic regulation of the tension or pressure." R. Moser. (Application for Patent of Addition to No. 6,103/09.) March 24th. (Complete.)

7,112. "Improvements in and relating to apparatus for the treatment of refractory materials." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 24th.

7,113. "Improvements in the control of electrically operated switches." A. S. Cubitt. (Date applied for under Sec. 91 of the Act, May 7th, 1908, being date of application in United States.) March 24th. (Complete.)

7,114. "Improvements in and relating to electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 24th.

7,121. "Improvements in or relating to apparatus for use in the distribution of alternating electric current." A. F. Berry. March 24th.

7,135. "New primary battery of intense power." H. R. Schrieder and J. R. Railton. March 25th.

7,141. "Improvements in portable electric safety lamps." T. W. B. Durant and R. W. A. Durant. March 25th.

7,143. "Improvements in incandescent electric lamps." O. Drey. March 25th.

7,150. "Improvements in arc lamps." W. A. Legge and F. A. Scott. (Application for Patent of Addition to No. 24,685, 1908.) March 25th.

7,166. "Improvements in methods of wireless signalling." L. H. Walter. March 25th.

7,179. "Improved indicator for testing electric conduits." C. Schmittutz and H. Grono. March 25th.

7,187. "Improvements in or relating to the sheathing of electrical conductors." H. W. Handcock, A. H. Dykes, J. J. Rawlings and W. Dieselhorst. March 25th.

7,190. "Radio-teleautograph." A. de Mailly-Chalon and L. Chautelot. March 25th. (Complete.)

7,193. "Improvements in electrical apparatus for medical and other purposes and in articles to which such apparatus may be applied." G. Bryant and C. H. Ivinson. March 25th.

7,198. "Improvements in electrical measuring instruments." M. Francois. (Date applied for under Sec. 91 of the Act, April 11th, 1908, being date of application in France.) March 25th. (Complete.)

7,203. "Improvements in and relating to the cooling of enclosed dynamo-electric machinery." Aktiengesellshaft Brown, Boveri et Cie. (Date applied for under Sec. 91 of the Act, March 30th, 1908, being date of application in Switzerland.) March 25th. (Complete.)

7,223. "Improvements in the fixing of an electric generator and pump gear in the frame of a windmill." J. A. Leeming. March 25th.

7,230. "Improvements in systems of electric motor control." British Thomson-Houston Co., Ltd. (Gen. Elec. Co., United States.) March 25th.

7,233. "Electric magnetic needle." E. Lehmann and L. London. March 25th.

7,276. "Improvements in time limit devices for use in connection with electro-magnetic circuit breakers." Electric and Ordnance Accessories Co., Ltd., and N. Collins. March 26th. (Complete.)

7,298. "Device for identifying an electric lead with its terminal." C. Isaac. March 26th. (Complete.)

7,299. "Improvements in or relating to magneto ignition devices." W. A. Trier. March 26th.

7,312. "Improvements relating to fire alarm systems." Sterling Telephone and Electric Co., Ltd., J. W. Black and H. Osborne. March 26th.

7,319. "Improvements in apparatus for the electro-deposition of metal, electrolytic cleaning, barrelling and the like." G. E. Osmond. March 26th.

7,337. "Method for producing an active iron mass for the negative electrode of a primary or secondary electrical element with alkaline electrolyte." Nya Ackumulator Aktiebolaget Jungner, A. T. K. Estelle and K. W. H. Evers. March 26th. (Complete.)

7,338. "Active mass for the negative electrodes of primary and secondary electric elements with alkaline electrolyte." Nya Ackumulator Aktiebolaget Jungner, A. T. K. Estelle and K. W. H. Evers. March 26th. (Complete.)

7,345. "Improvements in detachable snap on electrical couplings." O. H. Parsons. March 26th.

7,396. "Improvements in or relating to electrical induction furnaces." C. Grunwald. (Date applied for under Sec. 91 of the Act, August 15th, 1908, being date of application in Germany.) March 27th. (Complete.)

7,397. "Attachments for preventing the unauthorised removal of electric incandescent or glow lamps or adapters from their sockets or holders." E. Chaudoir and N. T. Rowley. March 27th.

7,408. "Improvements in electric capstans." Hydraulic Engineering Co., Ltd., and N. B. Ellington. March 27th.

7,410. "Improvements in portable electrically-driven drilling machines." D. H. de Daillens and A. Joris. March 27th. (Complete.)

7,424. "Improvements in secondary batteries." J. Stone & Co., Ltd., and A. H. Darker. March 27th.

7,425. "Improvements in and connected with apparatus for the electric lighting, heating, cooling, and ventilating of railway carriages and other vehicles." J. Stone & Co., Ltd., and A. H. Darker. March 27th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford price, post free, 9d. (in stamps).

1907.

Direct-Current Electrical Machinery. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 26,607. December 2nd. (Date applied for under International Convention, December 6th, 1906.)

Method of Producing High Frequency Electrical Oscillations and Apparatus Therefor. Fessenden. 28,647. December 30th. (Date applied for under International Convention, February 4th, 1907.)

1908.

Arc Lamps. A. Holman. 2,261. February 1st. (Post-dated September 1st 1908.)

Electric Clock Systems. A. R. Upward. 4,689. March 2nd.

Electrolytic Deposition of Metal on Hollow Articles. E. Friedheim. 4,744. March 2nd. (Date applied for under International Convention, March 4th, 1907.) (Application for Patent of Addition to No. 7,563 of 1907.)

Electric Controllers or Switches. C. W. Atkinson and E. Garside. 4,962. March 4th.

Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co., United States.) 5,971. March 17th.

Electric Fuses for Blasting and like Purposes. A. J. Jordan. 6,079. March 19th.

Apparatus for Use in Connection with Electric Cables. C. J. Beaver and E. A. Claremont. 6,477. March 23rd.

Current-Conducting Wire Terminals. V. Vernum. 7,565. April 6th.

Electric Foot-Warmer. O. Krüger. 8,148. April 18th.

Electric Cables. W. T. Henley's Telegraph Works Co. and J. H. W. Pfiffner. 9,790. May 5th.

Holders for Electric Lamps. A. F. Rook. 10,773. May 18th.